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ORCHARD SPRAYS IN NEW ZEALAND.

VII. COMBINATION SPRAYS.

G. H. CUNNINGHAM, Mycologist, Plant Research Station, Palmerston North.

IN New Zealand it is customary to combine orchard sprays with a view to reducing the number of applications. This practice is of advantage owing to the large number of individual sprays comprising the spray programme, necessary to control the different types of insects and fungi present in the orchard. Judicious combination may halve the number of applications, and thus reduce the total spray costs considerably, since application costs are actually greater than the cost of materials. Certain combinations possess the additional advantage of improving the therapeutant value of the individual sprays.

The major factors which determine the advantages or disadvantages of combination are: (*a*) The chemical nature of the spray compounds employed; (*b*) their physical properties; (*c*) the risk of injury to foliage and fruit; (*d*) the concentrations employed; (*e*) the fungous diseases and insect pests present; (*f*) previous or subsequent sprays applied to the plant; and (*g*) the effects of additive compounds of the nature of spreaders, activators, or adhesives. Of these, the aspects of disease and pest control, and of safety to the plant, are of primary importance; consequently combinations are discussed principally from these viewpoints.

The sprays in current employment are (1) lime sulphur, (2) colloidal sulphur, (3) lead arsenate, (4) bordeaux (or burgundy) mixture, (5) nicotine or nicotine sulphate, and (6) petroleum oils.

Lime sulphur is employed as a fungicide and, to a lesser extent, as an insecticide. A 1-per-cent. concentration is moderately effective (though inferior to petroleum oil) as a controllant of scale insects when applied during the dormant period. It is principally employed as a summer fungicide, being applied to pome fruits, stone fruits, vegetables, &c., at concentrations of from 0·083 per cent. to 0·1 per cent. (the former concentration for less tolerant varieties) for control of black-spot of apples, and leaf-rust and brown-rot of peaches, &c. The spray is also of value in combating soft-bodied insects, though seldom used alone for the purpose.

Colloidal sulphur is the most efficient fungicide to employ against mildews. It is also effective against leaf-rust and brown-rot of

stone fruits, and tomato leaf-mould. The spray is applied in the orchard at the concentration of 4 lb. of the paste to 100 gallons of water; under glass 2 lb. give comparable results.

Bordeaux mixture is the most efficient fungicide for the control of fungi other than mildews. Two concentrations are employed, 5–4–50 at green tip on pome fruits and bud movement on stone fruits; 3–4–50 for summer applications to pears, tomatoes, and other small fruits, potatoes, and other vegetables.

Lead arsenate is a stomach poison used to combat chewing insects such as codling-moth, leaf-roller caterpillar, bronze-beetle, and cherry slug. The standard concentration employed in the Dominion is 1½ lb. powder or 3 lb. paste per 100 gallons of water. It may be applied with safety to pome fruits, small fruits, potatoes, and most garden vegetables and flowers; but is unsafe to use on stone fruits other than English plums.

Nicotine or nicotine sulphate may be employed during the growing season on most plants, without risk of injury, to combat soft-bodied insects, such as aphides, leaf-hopper, mealy-bug, and red-mite. The standard concentration recommended is 0·05 per cent. nicotine.

Petroleum oil is employed to destroy insect eggs during the dormant season, and against soft-bodied insects during the growing period. For dormant applications winter oil is applied at a concentration of 4 per cent. against San Jose scale, and 3 per cent. against other scales. Summer oils are applied at concentrations of 2 per cent. on citrus, and from 1·0 to 1·5 per cent. on pome and stone fruits.

Simple Combinations.

1. Lime Sulphur.

(*a*) *Plus Colloidal Sulphur.*—During the past three seasons this combination has been widely used throughout the Dominion. It has proved to be effective in combating black-spot and powdery-mildew of apples, and leaf-rust and brown-rot of stone fruits. At concentrations of 2 lb. of colloidal sulphur to 100 gallons of 0·083 per cent. lime sulphur, satisfactory control of these diseases may be secured without risk of leaf scorch. A "spreader" is unnecessary with the combination.

(*b*) *Plus Acid Lead Arsenate.*—This combination has been employed for many years in the Dominion—since the introduction of commercial lime sulphur, in fact—for control of black-spot and chewing insects of the apple.

Unless prepared in the manner outlined below, the combination is liable to cause severe leaf scorch and fruit russet. Several opinions have been published as to the nature of the changes which take place when these sprays are combined (*q.v.*, Bradley and Tartar, 1910; Robinson and Tartar, 1915; Robinson, 1919; Goodwin and Martin, 1925; Andrew and Garman, 1926; Young, 1926; &c.). The most probable view is that partial exchange occurs between the lime, the sulphur, and the lead, leading finally to the liberation of water-soluble arsenic* and the formation of lead sulphide. The

* Water-soluble arsenic: The exact form in which this occurs is unknown; it is most probably present as soluble arsenic pentoxide (As_2O_5).

former is responsible for injury to plant tissues; the latter gives the combined spray a characteristic colour, indicating that change has occurred.

If prepared in the following manner the combination may be rendered as safe to plant tissues as lime sulphur or lead arsenate alone: First fill the spray-tank with lime sulphur solution. To the required quantity of lead arsenate powder add double the quantity of hydrated lime. Mix into a thin paste with water, and, with the agitator running, pour slowly into the tank. Apply the combined spray as rapidly as possible after its preparation.

The use of hydrated lime with this combination to alleviate injury was advocated by the Department of Agriculture in 1918, and became a regular practice until superseded by lime casein* "spreader." The lime should be of good quality and possess a high $Ca(OH)_2$ content, since, as Farley (1925) has shown, a sample containing much carbonate of lime tends actually to increase the soluble arsenate content of the spray. Thatcher and Streeter (1924) claimed that comparable results were secured when casein (4 oz. per 100 gallons of combined spray) were added to the lime sulphur, the lead arsenate, or to the mixture. Their work led ultimately to the substitution of commercial lime casein for hydrated lime. This has proved a retrograde step, however, since in recent tests this "spreader" has been found to be less satisfactory and more expensive than hydrated lime.

(c) *Plus Bordeaux Mixture.*—No advantage is gained, so far as is known, by combining lime sulphur and bordeaux mixture. The possible effects of combination are discussed, however, owing to the belief prevalent in certain localities that severe injury is liable to follow when lime sulphur is applied to apple trees sprayed a few days previously with bordeaux mixture.

As is shown elsewhere (Cunningham, 1934), when equivalent amounts of lime sulphur and copper sulphate are combined, a dark-brown precipitate of copper polysulphides is formed; and an apparently similar precipitate is produced when bordeaux mixture (containing the same amount of copper, in the form of copper hydroxide) is used in place of copper sulphate. This precipitate may be applied to apple trees without injury to fruit or foliage, provided equivalent amounts of the copper salt and lime sulphur are used and the lime sulphur is used at summer concentrations. If, however, the lime sulphur is in excess, the precipitate is redissolved, and a spray produced which contains quantities of soluble copper, which increases with the increase in the excess lime sulphur. When this is applied as a spray to apple trees, slight leaf scorch and somewhat severe fruit russet follows.

It is apparent that increased injury is liable to occur only when the concentrations of copper hydroxide and lime sulphur are such that soluble copper compounds are produced—that is, when the copper of the bordeaux is decreased below a certain amount, or the lime sulphur is increased. Soluble copper is not produced when 5-4-50 or 3-4-50 bordeaux is combined with 0·2 per cent. lime

* Lime casein; frequently sold under the name of "calcium caseinate."

sulphur. Consequently, there is no likelihood of injury occurring when these concentrations are employed in the field. Theoretically, the risk of injury is increased by an increase in the time interval between the bordeaux and lime sulphur applications, owing to weathering and consequent loss of copper salts from the former spray. No method is available for ascertaining this loss, but field tests have shown that no injury follows the use of these sprays when the bordeaux is applied at green tip and followed by lime sulphur at pink or pre-pink stages.

(*d*) *Plus Nicotine or Nicotine Sulphate.*—This combination may be used for combating fungi and soft-bodied insects attacking pome fruit and stone fruit trees. It is safe to employ, since no reaction occurs which is liable to affect the efficacy of either spray, or to induce injury in excess of that caused by lime sulphur alone, either with nicotine sulphate (Andrew and Garman, 1926), or, as we have ascertained, with nicotine. It is unnecessary to employ with the combination an activator to liberate the nicotine from the nicotine sulphate, the lime sulphur acting in this capacity (Worthley, 1927). No advantage is to be gained by the addition of commercial lime casein "spreader" to the combination; and soap—recommended by manufacturers for use with nicotine or nicotine sulphate when applied alone—should not be employed, as it reacts with the lime sulphur to form insoluble calcium soap.

(*e*) *Plus Petroleum Oils.*—No advantage is to be gained by combining lime sulphur with winter oil. The oil is most effective in destroying insect eggs when applied during early dormancy (Cunningham and Muggeridge, 1933), whereas lime sulphur has little, if any, value as a fungicide if applied at this period. The latter may be used alone to destroy insect eggs (at 1 per cent. concentration), but in such a case there is no point to be gained by using the oil spray.

It is unsafe to combine lime sulphur with summer oils emulsified or stabilized with soaps or ammonium compounds. When ammonium compounds have been employed for the purpose, soluble sulphur compounds are produced which are highly toxic to plant tissues (Cutwright, 1929; Gross and Fahey, 1930). If soaps are used as emulsifiers, they react with the lime sulphur, leading to the formation of insoluble calcium soaps and breaking of the emulsion.

Injury is also liable to follow when lime sulphur is applied to trees sprayed previously with summer oil emulsified or stabilized with ammonium compounds, or *vice versa*. The obvious method of avoiding this injury is to employ an oil which does not contain ammonia in free or combined form. This we have demonstrated by applying to apple trees without injury a combined spray of lime sulphur and a straight summer oil emulsified with lime casein. Alternatively, this injury may be avoided by applying the oil spray from five to seven days in advance of the lime sulphur (or colloidal sulphur) spray; or, if sulphur sprays have been applied previously to the trees, by allowing ten days to elapse before applying the oil. Gross and Fahey (1930) claimed that the addition of 5 lb. of hydrated lime per 100 gallons of oil spray (0·75 per cent. concentration) made it safe to apply within a day or so following lime sulphur.

(*f*) *Plus Iron Sulphate.*—The practice of adding iron (ferrous) sulphate to lime sulphur or the lime sulphur plus lead arsenate combination, with a view to minimizing spray injury, was originated in the United States in 1925 (Dutton, 1929). When equivalent solutions of iron sulphate and lime sulphur are combined* the mixture becomes black, and iron sulphide and sulphur are precipitated. When this precipitate is applied to the tree, within an hour or so the iron sulphide is oxidized to free (colloidal) sulphur and a rust-colured basic sulphate. Therefore the effect of the iron sulphate is to convert the lime sulphur to colloidal sulphur. Our experiments have shown that this is accomplished at the expense of the wetting and spreading properties of the lime sulphur, a loss of portion of the sulphur, and a decrease in the fungicidal efficiency of the spray. Consequently this combination is not recommended.

(*g*) *Plus Aluminium Sulphate.*—Aluminium sulphate has been employed in Nova Scotia (Taylor, 1929; Hockey, 1931) with lime sulphur or the combined lime sulphur plus lead arsenate or calcium arsenate sprays. Reduction of injury is claimed when 3·5 lb. of the salt are added to a spray containing 1 gallon of concentrated lime sulphur (polysulphide content not specified). The combination is not recommended, as it is somewhat costly, and produces H_2S gas which is inflammable, toxic to man, and corrodes the brass parts of the spray outfit.

(*h*) *Plus "Spreaders."*—Our experiments have shown that lime sulphur, being a caustic alkali applied as a liquid, has excellent wetting and spreading properties which are not materially improved by the addition of casein or lime casein "spreaders." Soaps cannot be employed, as they are precipitated as insoluble calcium soaps. Consequently no advantage is to be gained by the addition of available commercial "spreaders" to lime sulphur or the lime sulphur combinations discussed above.

2. LEAD ARSENATE.

(*a*) *Plus Lime Sulphur.* (See section 1 (*b*).)

(*b*) *Plus Colloidal Sulphur.*—This combination may be used when it is necessary to combat chewing insects and mildews. Our experiments indicate that no increase in injury follows the application of 1½ lb. lead arsenate and 4 lb. colloidal sulphur per 100 gallons. A "spreader" is unnecessary with the combination, since the colloidal sulphur contains appreciable quantities of a protective colloid which serves this purpose.

(*c*) *Plus Bordeaux Mixture.*—This provides a good stock spray for combating chewing insects and endoparasitic fungi attacking plants which will tolerate summer applications of bordeaux mixture. No significant chemical reaction occurs in the combination.

The preferable method of making the combined spray is first to prepare a full tank of bordeaux mixture, then with the agitator running, to add slowly the lead arsenate mixed with water to a thin cream.

* To precipitate completely the polysulphides in 100 gallons of 0·1 per cent. lime sulphur, approximately 2·6 lb. of iron sulphate are required

As the combination has poor spreading and adhesive properties, owing to the physical nature of both components, applications would be materially improved by the addition of a "spreader." Soaps cannot be employed, as they react with lead arsenate to form water soluble arsenic, and with the excess lime of the bordeaux to produce insoluble calcium soaps (Tartar and Bundy, 1913; Morris and Parker, 1914). Casein or lime casein improves spreading, but adversely affects the adhesive properties of the combined spray. Improvement in both factors may be secured by the addition of a low concentration (0·25 per cent.) of a highly refined unemulsified summer oil.

The combination of burgundy mixture with acid lead arsenate is not recommended, for the soda of the burgundy reacts with the lead arsenate to produce appreciable quantities of water soluble arsenic.

(*d*) *Plus Nicotine or Nicotine Sulphate.*—A combination of acid lead arsenate plus nicotine may be used to combat both chewing insects and soft-bodied insects. The combination is safe to apply to all plants which will tolerate lead arsenate, as no significant reaction occurs when the two sprays are combined.

An activator is necessary when nicotine sulphate is employed. For the purpose hydrated lime may be used at the rate of 5 lb. per 100 gallons of spray. Soaps cannot be used, for, as has been shown, they react with the lead arsenate to produce water soluble arsenic.

(*e*) *Plus Petroleum Oils.*—Petroleum oil and lead arsenate may be combined with advantage to produce an insecticide which is effective in combating both soft-bodied insects and chewing insects. The oil additionally improves the adhesive and spreading properties of the arsenate. For this reason the combined spray has recently been widely used in the United States for the control of codling-moth. In fact, adhesion is so improved that removal of spray residues has become a serious problem in that country, necessitating the use of costly washing machinery. Consequently, in the Dominion, the use of the combination is advisable only during the earlier part of the season against chewing insects (as bronze-beetle) which are difficult to combat.

The risk of injury following applications is considerable if the summer oil contains ammonium compounds, owing to the reaction of these with the arsenate to liberate appreciable volumes of water soluble arsenic (Robinson, 1932; Murray, 1932). Oils containing soaps as emulsifiers cannot be employed for the same reason. Consequently the combination is recommended only if prepared as follows: Emulsify a straight (unemulsified) summer oil by stirring into it the lead arsenate, mixing vigorously to form a stiff paste. To this add small quantities of water, stirring continuously until a thin cream is produced. Pour this slowly into the spray-tank (having filled this previously with water), with the agitator running. The spray should be applied as rapidly as possible, without stoppage, for, if agitation ceases, the emulsion will break and the oil form a film on the surface.

According to Pinckney (1923), if the oil is emulsified with soap prepared entirely from oleic acid, no reaction occurs with the arsenate. Unfortunately such a product is not available on this market.

(*f*) *Plus "Spreaders."*—As lead arsenate has poor spreading and adhesive properties, it is advisable to apply it combined with a "spreader." Soaps cannot be used for the purpose, as they react chemically to produce water soluble arsenic. Casein and lime casein are efficient spreaders, but unfortunately do not materially improve adhesion; on the contrary, they tend rather to reduce the volume of lead arsenate remaining on the tree, this loss being excessive when the casein content is in excess of 4 oz. per 100 gallons of spray.

The most efficient of the available "spreaders" are low concentrations of highly refined summer oil or fish-oil. The former may be employed at a concentration of 0·25 per cent., the latter at 4 fluid ounces per pound of arsenate powder (Hood, 1929). Injury is liable to occur if either is emulsified or stabilized with ammonia or soap compounds. It is therefore advisable to use unemulsified oils, and to emulsify them with the arsenate immediately before application in the manner outlined in the previous section.

3. Bordeaux Mixture.

(*a*) *Plus Lime Sulphur.* (See section 1 (*c*).)

(*b*) *Plus Colloidal Sulphur.*—Little is to be gained by the use of this combination, as when both ectoparasitic and endoparasitic fungi are present a preferable spray would be the lime sulphur plus colloidal sulphur combination discussed above. (Section 1 (*a*).)

(*c*) *Plus Lead Arsenate.* (See section 2 (*c*).)

(*d*) *Plus Nicotine or Nicotine Sulphate.*—This combination may be used for combating fungous diseases (excluding mildews) and soft-bodied insects on plants to which bordeaux may be applied during the growing season. At standard concentrations no increased injury is likely to occur, for according to Safro (1915) nicotine (as the sulphate) may be combined with bordeaux without chemical change.

No activator is necessary with this combination, the excess lime of the bordeaux acting in this capacity. A "spreader" is advisable, however. (See section 3 (*g*).) The bordeaux may be replaced with burgundy mixture without risk of increased injury.

(*e*) *Plus Petroleum Oils.*—With winter oil no advantage is to be gained by use of this combination, for the oil should be applied during early dormancy for effective destruction of insect eggs (Cunningham and Muggeridge, 1933), whereas bordeaux is useless if applied before green tip on pome fruits or bud movement on stone fruits.

Summer oil may be combined with bordeaux for combating fungous diseases and insect pests of citrus. This combination has been employed in the United States since 1919, first with kerosene emulsion, subsequently with petroleum oils. The oil should be used at a concentration of 2 per cent., and unemulsified, for if an

ammonium or soap emulsifier or stabilizer is present it reacts with the excess lime of the bordeaux, leading to the production of insoluble calcium soap and the liberation of free oil. To prepare the combination, fill the tank with 3–4–50 bordeaux, and then add the oil, first emulsified with 3 lb. of hydrated lime. The oil and lime should be mixed into a stiff paste, and small quantities of water then added until the mixture assumes the consistency of thin cream. This is poured slowly into the tank while the agitator is running.

(*f*) *Plus Hydrocyanic-acid Gas.*—American workers have shown that severe injury is liable to follow when citrus trees sprayed with bordeaux mixture are fumigated subsequently with hydrocyanic-acid gas (Fawcett, 1914; Woglum, 1923; Butler and Jenkins, 1930). This injury is liable to occur at any time up to six months after an application of bordeaux, and even after eleven months should the spray have been heavy and complete (Woglum, 1929) Although fumigation is not practised in the citrus orchards of the Dominion, the matter is nevertheless of significance as the process is employed for combating insect pests of the glasshouse, where under similar conditions severe injury may occur (Guba, 1926).

Butler and Jenkins (1930) have shown that injury is correlated with the ratio of copper sulphate to lime employed in making the bordeaux mixture. When this ratio is 1 : 0·2 (approximately neutral) injury does not occur, as an insoluble cuprous cyanide is produced; but as the amount of lime is increased the degree of injury is also increased. Beyond the neutral point, soluble cupric cyanide is produced; and in mixtures with ratios greater than 1 : 1, increasing quantities of a soluble double cupric cyanide is formed, injury increasing proportionately. They considered that injury from this source should not occur if a neutral bordeaux spray was employed. This spray is liable to cause foliage injury to plants grown under glass, so that it is advisable to replace bordeaux with sulphur sprays when fumigation is to be practised.

(*g*) *Plus "Spreaders."*—When properly prepared, bordeaux mixture has good adhesive but poor spreading properties. Although both factors may be improved by the use of a suitable "spreader," it is difficult to procure a type which will improve coverage without reacting adversely with the bordeaux. Soaps cannot be employed, as they are converted into insoluble calcium soaps by the action of the excess lime of the bordeaux. Casein and lime casein improve its spreading properties, but actually decrease the adhesion of bordeaux. Recent experiments have shown that a satisfactory agent to employ for the purpose is a low concentration (0·25 per cent.) of a summer oil. This should be unemulsified, and the combination prepared in the manner outlined under section 3 (*e*).

4. NICOTINE OR NICOTINE SULPHATE.

(*a*) *Plus Lime Sulphur.* (See section 1 (*d*).)

(*b*) *Plus Colloidal Sulphur.*—This combination may be employed without risk of injury to combat mildews and soft-bodied insects, being especially useful under glass. An activator is necessary when

nicotine sulphate is used. For the purpose soft soap (1 lb. for each pound of colloidal sulphur) may be used with advantage, being additionally an efficient wetting agent.

(*c*) *Plus Lead Arsenate.* (See section 2 (*d*).)

(*d*) *Plus Bordeaux Mixture.* (See section 3 (*d*).)

(*e*) *Plus Petroleum Oils.*—No advantage is to be gained by combining nicotine with winter oil, since the former is effective only against soft-bodied insects.

With summer oil nicotine may be combined with advantage, the combination being superior to either spray when employed against such pests as woolly-aphis, mealy-bug, thrips, or red-mite under glass, both the wetting and spreading properties of the nicotine being improved. If the summer oil is emulsified or stabilized with soaps or ammonium compounds, no activator is necessary with either nicotine or nicotine sulphate.

(*f*) *Plus "Spreaders."*—When nicotine or nicotine sulphate is employed alone it is of advantage with the former, and essential with the latter, to employ an activator. This increases the volatility of the nicotine and liberates it from nicotine sulphate. For the purpose manufacturers recommend soft soap, at from 4 lb. to 5 lb. per 100 gallons of spray. This material is satisfactory for the purpose and possesses the additional advantage of increasing the wetting properties of the spray. It has, however, the disadvantages of being somewhat costly and variable in composition. Cheaper and equally efficient activators are hydrated lime (5 lb. per 100 gallons) or washing-soda (3 lb.). When soap or washing-soda is employed, an interval of ten days should elapse before a lead arsenate spray is applied to the plant.

5. Colloidal Sulphur.

(*a*) *Plus Lime Sulphur.* (See section 1 (*a*).)

(*b*) *Plus Lead Arsenate.* (See section 2 (*b*).)

(*c*) *Plus Bordeaux Mixture.* (See section 3 (*b*).)

(*d*) *Plus Nicotine or Nicotine Sulphate.* (See section 4 (*b*).)

(*e*) *Plus Petroleum Oils.*—So far as I am aware, this combination has not been tested. With winter oil no advantage would be secured by the combined spray. It may be worth testing the efficacy of low concentrations (from 0·1 to 0·25 per cent.) of summer oil as a wetting and spreading agent to improve the efficacy of colloidal sulphur against such diseases as tomato leaf-mould. At present, however, the combination is not recommended, for nothing is known as to the possible reactions which may occur in the spray or subsequently on the tree.

(*f*) *Plus "Spreaders."*—The manufacturers of colloidal sulphurs recommend the employment of soft soap (1 lb. for each pound of the paste) to improve its spreading properties. As the brands we have tested contain appreciable volumes of a protective colloid (one containing 15 per cent. of sulphite lye), this addition appears to be unnecessary.

6. Petroleum Oils.

(*a*) *Plus Lime Sulphur.* (See section 1 (*e*).)
(*b*) *Plus Colloidal Sulphur.* (See section 5 (*e*).)
(*c*) *Plus Lead Arsenate.* (See section 2 (*e*).)
(*d*) *Plus Nicotine or Nicotine Sulphate.* (See section 4 (*e*).)

Triple and Quadruple Combinations.

The complexity of the chemistry of these is such that it is difficult, and frequently impossible, to state what reactions take place. Consequently, the only safe guides are (*a*) efficacy of disease and pest control, and (*b*) safety to plant tissues.

Field tests have shown that the following combinations may be applied during the growing season, at the concentrations recommended, without increased injury or decreased efficiency.

(*a*) *Lime Sulphur plus Lead Arsenate plus Nicotine.*—This produces, at standard concentrations, a combined spray which will combat endoparasitic fungi, soft-bodied and chewing insects. The lime sulphur and lead arsenate should be combined in the manner outlined under section 1 (*b*), and the nicotine (or nicotine sulphate) added immediately before spraying is commenced. As hydrated lime is used, no activator is necessary.

(*b*) *Lime Sulphur plus Lead Arsenate plus Colloidal Sulphur.*—This forms a spray which will combat ectoparasitic and endoparasitic fungi and chewing insects. It may be employed as a standard summer spray for the apple orchard in localities where mildew is prevalent. The colloidal sulphur should be added to the spray-tank after the lime sulphur and lead arsenate sprays have been combined, in the manner outlined in section 1 (*b*). A "spreader" is unnecessary.

(*c*) *Lime Sulphur plus Colloidal Sulphur plus Nicotine.*—A possible combination which is safe to employ, but purposeless, as it does not appear to have a place in the programme.

(*d*) *Lime Sulphur plus Lead Arsenate plus Colloidal Sulphur plus Nicotine.*—This produces a combined insecticide-fungicide which should effectually combat most diseases and pests of the apple, its employment being dictated by the prevalence of black-spot, powdery-mildew, chewing insects, and leaf-hopper or other soft-bodied insect pest. Use standard concentrations; combine the lime sulphur and lead arsenate in the manner specified in section 1 (*b*); add the colloidal sulphur, and finally the nicotine (or nicotine sulphate). No "spreader" is necessary.

(*e*) *Lead Arsenate plus Colloidal Sulphur plus Nicotine.*—A possible combination which might be employed safely where black-spot was absent from the apple orchard.

(*f*) *Lead Arsenate plus Bordeaux Mixture plus Nicotine.*—This may be employed safely on potatoes and tomatoes to combat endoparasitic fungi, chewing insects, and soft-bodied insects. Prepare the spray as indicated under section 2 (*c*), adding the nicotine last. An adhesive, such as a low concentration of an unemulsified summer oil, should materially improve wetting and adhesive properties of the combination.

(g) *Lead Arsenate plus Summer Petroleum Oil plus Nicotine.*—This combination is safe to employ, provided consideration is given to particulars set out in section 2 (*e*). It does not appear to have a place in the spray programme, however.

This lists the possible complex combinations safe to employ with standard sprays. Improvements, both in efficacy of disease and pest control, and in safety to plant tissues, will come mainly through improvements in spray applications and in so-called "spreaders," by the aid of which the wetting and adhesive properties of the sprays may be improved. That there is need for improvement in "spreaders" has been repeatedly suggested in the preceding pages.

The effects of hard waters on the preparation of sprays and combinations must not be overlooked, for, according to Heddon (1908), de Ong (1922), Yothers and Winston (1924), &c., these may indirectly cause severe injury. For, if mixed with lead arsenate, water-soluble arsenic may be formed in appreciable quantities; and if used with oil emulsions, may cause these to break, with consequent liberation of free oil.

Hard waters contain bicarbonates and sulphates of magnesium and/or calcium. Temporary hardness is due to the bicarbonates of these alkalies held in solution by excess carbonic acid. This temporary hardness may be removed by boiling the water, the carbonic acid being then liberated and carbonates of the alkalies precipitated. Permanent hardness is due chiefly to the presence of sulphates and chlorides of magnesium and calcium, and cannot be removed by boiling the water. Soaps may be employed for the purpose, but are somewhat costly, and water so treated cannot be employed for the preparation of lead arsenate, lime sulphur, or bordeaux mixture if the soap is used in excess of the amount required to precipitate the alkalies inducing hardness. De Ong (1922) considered that caustic soda was superior to soaps for the purpose; but the same objection applies with its employment, though the water may be used safely for the preparation of oil emulsions. Robinson (1932) recommended the use of hydrated lime to overcome the difficulty of mixing hard waters with lead arsenate, summer oil, or the combination. If the procedures outlined for the preparation of the different combinations are followed, then there is little likelihood of trouble being experienced with the hard waters present in the Dominion. These have little significant effect on lime sulphur, bordeaux mixture, nicotine sulphate, and colloidal sulphur; and if lead arsenate plus hydrated lime is used in combinations little trouble should follow. Breaking of oil emulsions should not occur if the directions given are followed.

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LAMB-FATTENING WITH WHEAT.

SOME POINTS ON ITS ECONOMIC USE IN CANTERBURY.

A. H. FLAY, Canterbury Agricultural College.

EXPERIENCE shows that lamb-fattening with wheat has a place in Canterbury farm economy, and that the practice is sound only under certain conditions. The object of this article is to specify some of these conditions and to indicate the main points to be considered before commencing to feed wheat to lambs.

Green Feed.—It is essential that some green feed should be available to lambs being fattened by the aid of wheat. A thriving lamb requires about 2 lb. of dry matter per day. This cannot be supplied satisfactorily by wheat alone, even though some very small quantity of other feed may be available. Generally, wheat should not supply more than half of the feed. The remainder may be new grass, specially saved top-dressed pasture, fresh growth on old grass, red

clover grazing, or any fair to good stubble. It must be realized, of course, that, provided there is abundance of any of these feeds, lambs will fatten on them without wheat.

If the quality of the feed is low, or the quantity limited, then wheat feeding has much to recommend it. On succulent new grass mixing good-quality oat-straw chaff with wheat assists in preventing undue scouring which sometimes occurs.

Condition of Lambs.—The condition of the lambs is a most important consideration before wheat feeding is commenced. It is readily realized that young, backward, or stunted lambs, would require many weeks of feeding at a cost of approximately 2d. per week for grain—not to mention the farmer's time—to make such lambs prime. Lambs should be in a good forward condition before feeding supplementary grain. The feeds mentioned above would be suitable for putting them in good forward condition. Wheat has its greatest value as a "finishing off" feed.

Cost of Wheat.—The average price received by Canterbury farmers for Solid Straw Tuscan wheat last year (1933) was 3s. 4d. per bushel. The price of seconds of wheat at lamb-fattening time last autumn was (approximately) 2s. 4d. to 2s. 6d. per bushel. When second-grade wheat is worth 9d. to 1s. a bushel less than first grade it is obvious that farmers—certainly those growing their own wheat—should use second-quality grain.

Price of Lambs.—The price of store lambs and of fat lambs, or the margin between these, is most important when any lamb-fattening by the aid of supplementary feeds is being considered, and especially so when a feed such as grain, that has a certain and direct cash value, is to be used.

If a line of store lambs worth, say, 12s. per head were fattened in eight weeks on suitable feed and then realized 16s., the margin would be 4s. per head. There is, of course, always the risk of a small percentage of deaths during this fattening period. With something less than 4s. therefore to be made out of fattening these lambs, it is obvious that fattening costs must not reach this figure—*i.e.*, if the necessary green grass or fresh stubble, and the farmer's time have no value, then about 3s. 6d. worth of wheat can be fed to each of the lambs without loss. At last year's prices this would be about 1½ bushels of second-grade wheat. It would be as well to state here that fresh green grass and the farmer's time do have some value, so that it is desirable for good lamb-fattening that not more than, say, 2s. worth of wheat per lamb be used. At last year's prices this would be about 48 lb. of second-grade wheat.

Amount to Feed.—At last year's prices as much as 48 lb. of seconds of wheat, or 33 lb. of first-grade wheat, may be fed per lamb. It is usually unwise to feed more than ½ lb. wheat per lamb daily. For an eight-week fattening-period the total grain used then would be 28 lb. per lamb. In reality, for the first seven to ten days very little grain is eaten, and it is not until two weeks' feeding has been carried out that lambs, on average, eat as much as ½ lb. per day. In fact it is essential to start feeding with only small quantities, which can be gradually increased to the desired ration by the end of ten to fourteen

days. After each feed troughs should be emptied so that lambs taking readily to wheat will not gorge themselves. This means that the maximum grain required to fatten a lamb in an eight-week period would be about 20 lb. to 25 lb.; at 2s. 6d. per bushel for second-grade wheat this would cost (taking the larger quantity) approximately 1s. per lamb.

During the last two summers several farmers have successfully supplemented their lamb-fattening feed with 10 lb. to 20 lb. of wheat grain. The lambs would have been sold as stores had grain not been used.

Alternatives to Wheat Feeding.—Where rape, turnips, kale, or young grass are grown they can be used for lamb-fattening purposes. They form a good rotation with grain crops and are sometimes essential in maintaining soil fertility. Cultivation and sowing are carried out at a time of the year when the team and teamster have least to do. On many farms, therefore, lamb-fattening by these crops will continue to be the most suitable and profitable method.

It is suggested, however, that if the greatest net returns are to be realized special crops for lamb-fattening, though important on many Canterbury farms, should be kept at a minimum and grain be used along with fresh permanent pastures, new grass, stubble feeds, &c., for finishing off good forward lambs. When good grazing is available, as in the late autumn, and other feeds are finished, the "finishing off" of lambs with grain is most profitable. Store lambs at this time usually have a low value.

The main points as experienced by many Canterbury farmers, fattening lambs by the aid of wheat, may be summarized as follows:—

(1) Green feed: Fresh good grass, red clover, or fair to good stubble must be available.

(2) Condition of lambs: Only good forward stores should be "finished off" with wheat.

(3) Value or price of grain: Only second-quality grain, if possible.

(4) Margin between store and fat lamb prices: For good and profitable fattening it is recommended that the difference between the prices of store and fat lambs be about double that of the value of grain used per lamb.

(5) Quantity fed per day: About ½ lb. wheat per lamb daily should be used. Lambs must not be allowed to gorge themselves at any time, especially when commencing wheat feeding.

(6) Fattening period: It is desirable that this be not more than eight weeks, but ten weeks or more may be profitable. A six-week period is more economical.

(7) Other feeds available on farm: If good-quality red clover, grass, or stubble are available in abundance, or rape, turnips, &c., that have no direct cash value, can be used, then it would be more profitable to fatten all the lambs or a portion of them on these, and to sell the wheat, or not buy it for fattening purposes.

My thanks are due to all those farmers, especially Mr. H. T. Reeves, Hororata, who kept details for the last four years concerning their lamb-fattening.

EFFECTS ON APPLE-TREES OF LIME SULPHUR FOLLOWING BORDEAUX MIXTURE.

G. H. CUNNINGHAM, Mycologist, Plant Research Station, Palmerston North.

MANY orchardists hold that leaf and fruit injury results when lime sulphur is applied to trees sprayed with bordeaux mixture, unless a considerable time interval is allowed to lapse between applications. This belief was promulgated by one who, under the pen-name of "N.Z. Orchardist," in 1919 and 1920 contributed an article to several newspapers* in New Zealand and Australia. In this it was claimed that reaction occurred between the lime sulphur and bordeaux residues on the tree, leading to the formation of copper sulphide, which produced sulphuric acid when in contact with water. This acid was believed to attack and destroy the stalks of fruits and leaves.

The matter was investigated by the Horticulture Division of the Department, and a series of experiments was conducted in orchards at Arataki (Hawke's Bay) and Christchurch. Results secured, which were subsequently published†, showed that under the conditions of the tests, based on current spray practices, no noticeable injury resulted.

Notwithstanding these experiments, the belief still persists among orchardists in certain localities. Consequently several field and laboratory experiments have been undertaken to ascertain whether injury occurs, and, if so, whether it is possible to prevent such under field conditions.

When equivalent solutions of copper sulphate and lime sulphur are combined‡, a heavy dark-brown precipitate is produced, which is soluble in excess lime sulphur. If bordeaux mixture, containing the same amount of copper (in the form of copper hydroxide) is used in place of the copper sulphate, a similar precipitate, also soluble in excess lime sulphur, is formed. This latter precipitate is somewhat different in that it is heavier and less flocculent, possibly owing to the presence of quantities of calcium hydroxide. The precipitate would appear to be composed of a mixture of copper polysulphides and cupric sulphide§.

To ascertain whether injury is liable to occur, the following experiments were undertaken. Trees of the varieties Delicious,

* *Cf.*: *The Nelson Colonist*, 15th October, 1919; *The Fruit World of Australasia*, January, pp 3-4, 1920.

† *New Zealand Journal of Agriculture*, Vol 19, pp. 371-374, 1919; *New Zealand Fruitgrower*, Vol 3, January, 1920.

‡ We have ascertained that 5 grammes of copper sulphate are required to precipitate completely 9 c.c. of 18-per-cent. calcium polysulphides. Amner's lime sulphur was used in these tests.

§ According to Mellor ("A Comprehensive Treatise on Inorganic and Theoretical Chemistry," Vol. 3, p. 225), a precipitate of cupric sulphide and copper polysulphide, soluble in excess ammonium polysulphide, is produced when copper salt solutions are treated with ammonium or potassium polysulphides. As copper sulphate and lime sulphur behave similarly, it is reasonable to assume that the precipitate is of similar composition.

Jonathan, Sturmer, and Rome Beauty were sprayed in early December with the following compounds:—

(*a*) Lime sulphur alone at 0·1 per cent. concentration.

(*b*) A precipitate obtained by combining equivalent amounts of copper sulphate and 0·1 per cent. lime sulphur.

(*c*) A precipitate obtained by combining equivalent amounts of bordeaux mixture and 0·1 per cent. lime sulphur.

(*d*) A solution containing half the amount of copper sulphate used in (*b*) dissolved in 0·1 per cent. lime sulphur.

Additionally, one tree in each series was sprayed with water daily for fourteen days with a view to increasing the possibility of injury.

No injury has been observed on trees in series (*a*), (*b*), and (*c*). In series (*d*), however, slight leaf-scorch was noticed on Sturmer and Delicious varieties, and fruits of all trees showed somewhat severe injury. This was most noticeable around the periphery of spray deposits, in several instances a ring of small black lesions being produced at this point. This injury is due to the soluble copper compounds present in the spray, and, judging from these experiments, is liable to occur only when lime sulphur is in considerable excess of the copper salt. The fact that no injury followed applications (*b*) and (*c*) is significant. For if the amount of copper sulphate used (equal to 3 lb. per 100 gallons) were applied alone, severe injury would have resulted; and a bordeaux application of equivalent concentration would have produced fruit russet. Combination therefore produces sprays which are at least as safe to apply to trees in leaf as 0·1 per cent. lime sulphur. It is doubtful, though, if anything is to be gained by the combination; for when applied to trees it produces a heavy black deposit which disfigures fruits and leaves. This deposit is very adhesive, when prepared with copper sulphate, persisting for weeks without appreciable diminution, and appears less fungicidal to black-spot than 0·1 per cent. lime sulphur.

These results, while not conclusive, are sufficiently definite to indicate that no injury follows applications of a bordeaux mixture or copper sulphate plus lime sulphur combination, provided the lime sulphur is not in excess. Approximately 3 lb. of copper sulphate are required to precipitate completely the polysulphides in 100 gallons of 0·1 per cent. lime sulphur. Consequently soluble copper compounds are not formed when 3–4–50 bordeaux is combined with 0·2 per cent. lime sulphur, as an approximately neutral compound is produced. By decreasing the copper content, or by increasing the lime sulphur, injury is likely to result, owing to the formation of soluble copper compounds.

Theoretically, therefore, injury would actually be increased by increase in the time interval between bordeaux and lime sulphur applications, owing to weathering of the bordeaux with consequent loss of copper salts. It is not possible to ascertain this loss, owing to the complex of factors involved. Field tests conducted at the Research Orchard, Nelson, and at this Station have shown that no noticeable injury follows application of 0·2 lime sulphur at pink or pre-pink to trees sprayed at green tip with bordeaux 5–4–50. This is substantiated by the earlier experiments conducted at Arataki and

Christchurch. These results suggest either that little loss of copper occurs during this period, or more probably that the copper hydroxide of the bordeaux is after deposition converted into an insoluble compound of the nature of copper carbonate. If such were produced on the tree, then there would be little likelihood of reaction between this compound and lime sulphur, since in our tests no reaction was secured when equivalent amounts of copper carbonate and lime sulphur were combined.

It is safe to conclude, therefore, that injury is not likely to follow when apple-trees are sprayed with either 5-4-50 or 3-4-50 bordeaux mixture at green tip, and followed at pink or pre-pink stages with 0·2 per cent. lime sulphur.

I am indebted to Mr. R. L. Andrew, Assistant Dominion Analyst, Dominion Laboratory, Wellington, for literature references; to Mr. J. D. Atkinson, Research Orchard, Nelson, for carrying out several field tests; and to Mr. E. E. Chamberlain, of this laboratory, for the preparation of the materials employed in tests conducted at this Station.

INVESTIGATIONS IN PASTURE PRODUCTION.

VI. STUDIES OF EFFECT OF SULPHATE OF AMMONIA AND FREQUENCY OF CUTTING ON PRODUCTION OF PASTURE UNDER SYSTEM OF MOWING ONLY.

A. W. HUDSON, Crop Experimentalist, Plant Research Station, Department of Agriculture, Palmerston North.

THREE experiments which have been described fully in Part VI of Bulletin No. 31 of the Department of Scientific and Industrial Research, and which were carried out at the Marton Experimental Farm, will be described briefly in this article. Unlike the experiments discussed in II to V of this series, the yields of which were measured under the system of alternate mowing and grazing, the experiments described herein were under mowing only. It was not intended to keep them going for more than one season, during which time the effect of mowing only was not expected to influence the botanical composition greatly. However, circumstances arose which rendered it desirable to maintain the trials for about three years.

It is appropriate to discuss some points common to all experiments at this stage. All three experiments were laid down on the same pasture in the same enclosure. All had treatments receiving sulphate of ammonia, the quantities and frequency of application differing with the different experiments, however.

The three experiments will be designated A, B, and C respectively. A and B were carried on for about two years and ten months, and C for about three years and two months.

The pasture was an excellent one for the class of soil, consisting almost entirely of perennial rye-grass and white clover. In spite of the drastic treatment of mowing with removal of herbage the rye-grass persisted without any apparent diminution in the number of plants,

although it produced very little except in the autumn, winter, and spring, when rye-grass growth, relative to that of clover, is more prolific. At other times of the year white clover dominated the production, except when the grass growth was stimulated by recent applications of sulphate of ammonia. Generally speaking, all sulphate of ammonia applications increased production for periods of from a few weeks to a few months after application, depending on the time and amount of the application. The period of beneficial effect of each application of sulphate of ammonia was generally followed by a period of slumping in production which coincided with a reduction in the amount of clover growth and more or less unthrifty appearance of the grass. Weed growth was reduced appreciably by the sulphate of ammonia.

The quantities and frequency of application of sulphate of ammonia were greater than those used or advocated in practice; consequently the undesirable effects shown are undoubtedly more marked than would occur where, say, 1 cwt. of sulphate of ammonia is being used once in two or three years on the same pasture for the production of out-of-season grass. It is probable that under most conditions the latter practice does not result in sufficiently serious slumping to outweigh the benefits derived from the production of early or late season grass, so long as common-sense management, including the use of lime, phosphate, and/or potash where necessary, is carried out.

These trials indicate, however, that sulphate of ammonia cannot be used regularly and intensively without undesirable consequences.

Experiment A.—An Investigation into the Effect of applying Frequent Heavy Dressings of Sulphate of Ammonia in Conjunction with Carbonate of Lime.

This experiment was commenced on the 15th November, 1929, and continued until 23rd September, 1932, a matter of two years and ten months.

The object of the trial was to determine whether the effectiveness of sulphate of ammonia applications would be influenced by the time or frequency of applying the lime used to check soil acidity. (About 1½ to 2 cwt. of ordinary ground limestone is required to check the acidifying effect of 1 cwt. of sulphate of ammonia.)

Heavy and frequent applications of sulphate of ammonia were used to intensify any differences which might result.

The treatments under trial were: (1) No sulphate of ammonia; (2) and (3)* sulphate of ammonia 2 cwt. per acre three times a year.

All plots received a basal dressing of 16 cwt. of ground limestone before the trial commenced, and super at 4 cwt. per acre, and 30 per cent. potash at 2 cwt. per acre were applied annually.

Applications of sulphate of ammonia were made on the following dates: 18th November, 1929; 2nd April, 29th July, and 15th December, 1930; 24th April and 5th August, 1931.

* Treatment 2 received 12 cwt. of ground limestone per acre once a year while the sulphate of ammonia dressings were being applied. Treatment 3 received 4 cwt. of ground limestone mixed with the sulphate of ammonia when it was applied (12 cwt. per acre per annum).

No further applications were made after that in August, 1931, because slumping in production, following the period of increased growth resulting from the nitrogen application, was becoming progressively worse, and it was decided to determine the duration of the slumping.

Each treatment was replicated twelve times, and during the period under review forty-seven cuts of successive growths were taken.

The yields from Treatment 1 (no sulphate of ammonia) for each of three seasons were as follows :—

Pounds per Acre.

——	1929–30. 15/11/29 to 11/10/30 (330 Days).	1930–31: 11/10/30 to 9/10/31 (363 Days).	1931–32 9/10/31 to 23/9/32 (350 Days).
Green herbage	29,073	34,376	26,015
Dry matter	*	6,212	5,223

* Dry matter not determined.

The effect of the sulphate of ammonia applications on the total yields for each of the above periods is indicated from the relative yields which follow :—

Treatment

Season.	No Sulphate of Ammonia. 1.	Sulphate of Ammonia plus Lime annually. 2.	Sulphate of Ammonia mixed with Lime. 3.	Remarks.
1929–30. Green herbage	100	103·7	108·2	6 cwt sulphate of ammonia used on 2 and 3.
1930–31—				
Green herbage ..	100	99·3	100·4	6 cwt. sulphate of ammonia used on 2 and 3.
Dry matter ..	100	108·1	108·5	
1931–32—				
Green herbage ..	100	76·8	78·3	No sulphate of ammonia used on 2 and 3.
Dry matter ..	100	83·3	84·4	

Dry-matter determinations were carried out over the second and third periods. Over each period as a whole the dry-matter content of the herbage from the sulphate of ammonia treated plots was higher than from No Sulphate of Ammonia as is indicated by the following figures :—

Percentage of Dry Matter in Herbage.

——	No Sulphate of Ammonia. 1.	Sulphate of Ammonia plus Lime annually. 2.	Sulphate of Ammonia mixed with Lime. 3.
1930–31	18·1	19·7	19·5
1931–32	20·1	21·8	21·6

As a result of this, the yields of dry matter show results more favourable to the sulphate of ammonia dressings than the yields of green herbage do.

Each dressing of sulphate of ammonia increased production for several weeks after its application. However, the slumping following the period of increase offset a good deal of this increase, especially in the third season, when the applications of sulphate of ammonia were discontinued.

Production from Treatments 2 and 3 slumped below that from Treatment 1 from early October, 1931, to about the end of May, 1932 (eight months). All treatments produced at about the same rate during June, July, and early August, 1932; but slumping occurred again from the middle of August until the 23rd September when the trial was abandoned.

The lime used checked any acidifying effect of the sulphate of ammonia on the soil, which was practically neutral in its reaction in the top 2 in., but slightly acid at 4 in. to 6 in. depths in all treatments. It can be concluded, therefore, that the influence of sulphate of ammonia on soil acidity as a factor in causing the undesirable effect on yield was eliminated.

Experiment B.—An Investigation into the Effect of Frequency of Cutting on the Production from Pasture and the Use of Sulphate of Ammonia under Different Frequencies of Cutting.

A period of two years and ten months from the 15th November, 1929, to the 23rd September, 1932, was covered in this investigation.

The objects were (i) to determine the effect of frequency of cutting on yield and (ii) to determine whether frequency of cutting had any influence on the response to sulphate of ammonia.

Cutting was carried out at two different stages: (*a*) when considered suitable for sheep-grazing, and (*b*) when suitable for cattle-grazing. These will be referred to as the "sheep" and "cattle" stages respectively. In the latter, cutting was done half as frequently as at the sheep stage.

The fertilizer treatments under trial were—1 and 3: No sulphate of ammonia; 2 and 4: Sulphate of ammonia at 1 cwt. per acre three times a year.

Treatments 1 and 2 were cut at the sheep stage of growth, and Treatments 3 and 4 at the cattle stage.

All plots received 16 cwt. per acre of ground limestone prior to the commencement of the trial, and 4 cwt. of superphosphate and 2 cwt. of 30-per-cent. potash salts were applied each year.

Applications of sulphate of ammonia were made on the following dates: 18th November, 1929; 2nd April, 29th July, and 23rd December, 1930; 13th May and 12th August, 1931.

Sulphate of ammonia was not used after the application in August, 1931, for the reason stated in the discussion on Experiment A.

There were nine replications of the plots of each treatment, and during the period of two years and ten months forty-nine cuts were taken on the series cut at the sheep-grazing stage and twenty-five on the cattle series.

Production.—The production from Treatment 1 (no sulphate of ammonia, cut at sheep stage) is shown below for each of the three seasons.

Pounds per Acre.

—	1929–30: 15/11/29 to 30/10/30 (349 Days).	1930–31: 30/10/30 to 5/10/31 (340 Days).	1931–32: 5/10/31 to 23/9/32 (354 Days).
Green herbage	28,421	31,232	27,908
Dry matter	*	5,503	5,433

* Dry matter not determined.

The yields of the other treatments relative to Treatment 1 as 100 were as follows:—

—	Sheep Stage.		Cattle Stage.		Remarks.
	No Sulphate of Ammonia. 1.	Sulphate of Ammonia. 2.	No. Sulphate of Ammonia. 3.	Sulphate of Ammonia. 4.	
1929–30: Green herbage	100	100·8	114·4	112·6	3 cwt. sulphate of ammonia used on 2 and 4.
1930–31—					
Green herbage	100	101·6	103·2	106·4	3 cwt sulphate of ammonia used on 2 and 4.
Dry matter ..	**100**	**105·1**	**100·2**	**105·2**	
1931–32—					
Green herbage	100	89·8	112·7	102·8	No sulphate of ammonia used on 2 and 4.
Dry matter ..	**100**	**92·9**	**115·4**	**106·4**	
Green herbage for whole period	100	97·6	109·8	107·3	
Dry matter for two seasons	100	99·0	107·7	105·8	

Cutting less frequently at the cattle stage has resulted in about 10 per cent. greater production of green herbage over the whole period. The superiority of the less-frequent cutting was most marked in the spring months, but resulted in slightly lower production during the winter.

The sulphate of ammonia has had practically no effect on the total production. The beneficial effect which followed each application was followed in turn by slumping in production. This was not so severe as in Experiment A, however, where double the quantity of sulphate of ammonia was applied at each dressing. The effectiveness of the sulphate of ammonia was not influenced appreciably by the frequency of cutting.

EXPERIMENT C.—AN INVESTIGATION INTO THE EFFECT ON PASTURE PRODUCTION OF ANNUAL APPLICATIONS OF SULPHATE OF AMMONIA TO DIFFERENT PLOTS AT TWO-MONTHLY INTERVALS THROUGHOUT THE YEAR.

The experiment described on next page was carried on for three years and one month from the 14th August, 1929, to the 22nd September, 1932.

Experience indicated that the most useful place for nitrogen on grassland in New Zealand was in the production of out-of-season winter and spring grass, and that nitrogen was more effective when used for this purpose.

The trial was planned to determine the effect of sulphate of ammonia applications made at approximately two-monthly intervals throughout the year. On account of the system of mowing adopted, the results obtained are more applicable to grassland under haying conditions than under grazing.

The treatments were—

(1) No sulphate of ammonia.

(2) to (7) Sulphate of ammonia 2 cwt. per acre with an interval of about two months between the application to one treatment and the next in order to receive it.

All plots received 16 cwt. of ground limestone at the commencement of the trial and 4 cwt. of superphosphate and 2 cwt. of 30-per-cent. potash salts each year.

The sulphate of ammonia dressings were applied each year as under:—

Treatment (2): July or August.
Treatment (3): September or October.
Treatment (4): November or December.
Treatment (5): January or February.
Treatment (6): March or April.
Treatment (7): May or June.

There were twelve replications of each treatment, and during the period of three years and one month, fifty-three cuts were measured.

It is proposed to discuss only the salient features of the results.

Although each of Treatments (2) to (7) received 6 cwt. of sulphate of ammonia (three applications of 2 cwt. each) during the period covered, none of them differed in yield by more than about 5 per cent. from the No Nitrogen treatments. Every application increased production for a time, the periods of increased production varying from about six to twenty weeks. Applications such as those in September-October made at the commencement of periods of high natural production were characterized by relatively big increases in daily rate of growth for short periods; those, such as the May–June ones, made prior to periods of naturally slow growth, although great in their effect relative to the No Nitrogen production, caused smaller rates of daily increases which extended over longer periods.

The beneficial effect from every application was followed by a period of slumping in production. The intensity of the slumping increased progressively with successive applications of sulphate of ammonia.

The dry-matter content of the herbage from nitrogen-treated plots was higher over the period as a whole, during which dry matter was determined than that from the No Nitrogen plots. The dry-matter yields as percentages of the green-herbage yields of Treatments (1) to (7) respectively were: 18·7, 18·9, 19·1, 19·3, 19·3, 19·4, 19·4.

VII. THE INFLUENCE ON PRODUCTION OF CONTINUOUS MOWING OF A PASTURE WITH REMOVAL OF HERBAGE COMPARED WITH A SYSTEM OF ALTERNATE MOWING AND GRAZING WITH "FEEDING BACK" OF HERBAGE ON TO THE PASTURE, OVER A PERIOD OF THREE YEARS.

THE technique of measuring pasture production under a system of alternate mowing and grazing with the feeding back of the herbage was described in the first article of this series. (This *Journal*, August, 1931.) The disadvantages of mowing only, with the removal of the cut herbage, were also discussed in the above-mentioned article, and the removal of lime, phosphate, potash, and nitrogen commented on.

Two experiments on adjoining portions of the same pasture at the Marton Experimental Farm lend themselves admirably to a comparison of the effect on production over a period of three years of mowing only versus the alternate mowing and grazing technique.

During the first two years the treatments compared in the respective experiments received the same quantities of fertilizers. There was a small difference in the third season, which is of no consequence in relation to the differences in yield which resulted between the two experiments.

The experiments will be designated A and B The following quantities of lime, phosphate, and potash were applied during the three years :—

—	Ground Limestone	Superphosphate.	30 per cent Potash
	Cwt.	Cwt.	Cwt.
A	16	16*	8
B	24	12	8

* The fourth application of 4 cwt. was made only four months before the end of the period under discussion, and did not have time to exercise much effect on yield

The production from each experiment during each of the three seasons resulted as follows :—

—	Pounds per Acre.	
	A. Under Mowing only.	B. Under Alternate Mowing and Grazing.
1929–30 : Green herbage	33,756	24,100
1930–31—		
Green herbage	36,488	43,786
Dry matter	6,610	7,781
1931–32—		
Green herbage	28,273	42,238
Dry matter	5,469	8,107

The poorer yield of B in 1929–30 is attributed to a weakness in the alternate mowing and grazing technique. This was discussed in the *Journal* for August, 1931 (p. 90), and eliminated by a modification of the technique in 1930–31.

In 1930–31 both experiments yielded more than in the previous season, due to a better season, and also, in the case of B, to the improvement in the technique. In 1931–32 production from A, under mowing only, fell away markedly, whereas that of B was maintained.

The writer is of the opinion that production of a pasture can be as satisfactorily maintained under the system of alternate mowing and grazing as under intensive rotational grazing.

The above is discussed more fully in Part VII of Bulletin No. 31 of the Department of Scientific and Industrial Research. A more up-to-date description of the technique now practised has been published by the Imperial Agricultural Bureau (Herbage Plants), Aberystwyth, Wales, in Bulletin No. 11, pages 21 to 31.

(Conclusion of Series.)

POTATO-MANURING EXPERIMENTS IN THE SOUTH ISLAND.

SEASON 1932–33.

Fields Division.

THE programme of potato-manuring experiments for 1932–33 comprised six trials, four of which were located in Canterbury while two were carried out in Southland. This programme was a continuation of the one initiated during the previous season, the results of which were given in the Journal for February, 1933, in which trials were designed to further investigate the effect of varying the quantities of sulphate of ammonia and sulphate of potash.

TYPE OF EXPERIMENTS.

Apart from one experiment, the trials were virtually of the same type, differing only in respect of one treatment, and for convenience are grouped under Type A experiments. The single exception is designated Type B.

Type A.—To determine the effect of varying the quantities of sulphate of ammonia and/or sulphate of potash.

Treatments per Acre.

1. Superphosphate (44–46 per cent.) 3 cwt.
2. (*a*) Super 3 cwt. plus sulphate of ammonia 1 cwt.
   (*b*) Super 3 cwt. plus sulphate of potash 1 cwt.
3. Super 3 cwt. plus sulphate of ammonia 1 cwt. plus sulphate of potash 1 cwt.
4. Super 3 cwt. plus sulphate of ammonia 1 cwt. plus sulphate of potash 2 cwt.
5. Super 3 cwt. plus sulphate of ammonia 2 cwt. plus sulphate of potash 1 cwt.
6. Super 3 cwt. plus sulphate of ammonia 2 cwt. plus sulphate of potash 2 cwt.

Five experiments of this type were carried out.

In three of the Canterbury experiments Treatment 2 (*b*) was omitted, while Treatment 2 (*a*) was not included in the two Southland trials. In one experiment a supplementary trial in which super 3 cwt. per acre was compared with No Manure was laid down alongside the main trial.

Type B.—To determine the effect of increasing the quantity of super from 3 cwt. to 5 cwt. and the amount of sulphate of ammonia from 1 cwt. to 2 cwt.

Treatments per Acre.

1. Super 3 cwt.
2. Super 5 cwt.
3. Super 5 cwt. plus sulphate of ammonia 1 cwt.
4. Super 5 cwt. plus sulphate of ammonia 1 cwt. plus sulphate of potash 1 cwt.
5. Super 5 cwt. plus sulphate of ammonia 2 cwt.

One experiment of this type was laid down. Treatment 1 was compared with Treatment 2 in plots alongside the remainder of the trial.

Size of Plots and Number of Replications.

In all trials single-row plots were used and each plot was 2 chains in length, except in one experiment where the length of plots was only 1 chain. In the majority of experiments twenty replications of treatments were sown. The trial in which plots were 1 chain in length, however, contained forty replications, while in another instance the area available allowed of only fifteen replications being laid down. The supplementary trials super 3 cwt. versus no manure and super 3 cwt. versus super 5 cwt. referred to above only contained ten replications.

In order to reduce the influence of possible " fertility slope " on yields, the experiments were divided up into series each containing four to ten replications. Treatments were arranged to run in opposite order in each alternate series.

Interpretation of Results.

Results were examined statistically, using " Student's " method. Differences are stated to be either " significant," in which case they can be accepted with confidence, or " not significant," when they are not necessarily due to the treatment, but may be due to natural variation.

Economic Aspect of Results.

It is not considered advisable to discuss the economic aspect of the results at this stage, but rather to summarize the effects of the fertilizers after several seasons' trials have been completed.

Results of Experiments.

The yields from individual treatments in the Type A experiments are given in Tables 1 to 5, and those in the Type B experiments are given in Table 6. Other details in connection with each experiment precede the tables. Although in most cases three grades of potatoes were weighed—*i.e.*, table, seed and small—only the weights of the first two grades are shown, but small potatoes are included in the totals. Differences between the various treatments are shown in Table 7.

Results of Type A Experiments.

1. *Co-operating Farmer: C. Redmond, Kimberley.*

Variety: Aucklander Short Top. Date planted: 2nd November, 1932. Twenty replications of plots. Previous crop: Grass, three years. Crop dug and weighed: 10th May, 1933.

Table 1.—Results of C. Redmond's Experiment.

Treatment per Acre.	Yield in Tons per Acre.		
	Table.	Seed.	†Total.
No manure*	3·9	2·0	5·9
1. Super 3 cwt	5 3	2·6	7·9
2. Super 3 cwt. plus sulphate of ammonia 1 cwt.	5·4	3·2	8·6
3. Super 3 cwt. plus sulphate of ammonia 1 cwt. plus sulphate of potash 1 cwt	5·4	3·3	8·7
4. Super 3 cwt. plus sulphate of ammonia 1 cwt. plus sulphate of potash 2 cwt.	5·2	3·3	8·5
5. Super 3 cwt plus sulphate of ammonia 2 cwt. plus sulphate of potash 1 cwt	5·6	3·2	8·8
6. Super 3 cwt. plus sulphate of ammonia 2 cwt. plus sulphate of potash 2 cwt.	5·6	3·3	8·9

* Used in supplementary trial in comparison with super 3 cwt. Yields have been adjusted to show true differences from super 3 cwt. which were significantly in favour of the latter by 1·4 tons table, 0·6 tons seed, and 2 tons total potatoes.

† Total yields include yields of "small" potatoes in all tables

2. *W. A McPhail, Mitcham (Canterbury).*

Variety: Dakota. Date planted: 19th October, 1932. Previous crop: Grass, three years. Crop dug and weighed: 22nd June, 1933. Forty replications of plots.

Table 2.—Results of W. A McPhail's Experiment

Treatment per Acre.	Yield in Tons per Acre.		
	Table.	Seed.	Total.
1. Super 3 cwt.	1·7	2·0	5·6
2. Super 3 cwt. plus sulphate of ammonia 1 cwt.	1·7	2·1	5·7
3. Super 3 cwt plus sulphate of ammonia 1 cwt. plus sulphate of potash 1 cwt.	1·9	2·2	6·1
4. Super 3 cwt. plus sulphate of ammonia 1 cwt. plus sulphate of potash 2 cwt.	1·9	2·1	6·0
5. Super 3 cwt. plus sulphate of ammonia 2 cwt plus sulphate of potash 1 cwt	1·9	2·2	6·4
6. Super 3 cwt. plus sulphate of ammonia 2 cwt. plus sulphate of potash 2 cwt.	2·0	2·2	6·2

This was a poor crop on account of the long continued dry spell which occurred in this district during practically the whole period of the experiment.

3. *Boys' High School, Timaru.*

Date planted: 10th November, 1932. Previous crops: 1931–32, oats; 1929–31, grass. Crop dug and weighed: 26th May, 1933. Fifteen replications of plots.

Table 3.—Results of Experiment at Timaru Boys' High School.

Treatment per Acre.	Yield in Tons per Acre.		
	Table.	Seed.	Total.
1. Super 3 cwt.	4·2	2·6	6·8
2. Super 3 cwt. plus sulphate of ammonia 1 cwt.	4·6	2·7	7·3
3. Super 3 cwt plus sulphate of ammonia 1 cwt. plus sulphate of potash 1 cwt.	4·7	2·6	7·3
4. Super 3 cwt. plus sulphate of ammonia 1 cwt. plus sulphate of potash 2 cwt	5·3	2·5	7·8
5. Super 3 cwt plus sulphate of ammonia 2 cwt plus sulphate of potash 1 cwt.	4·9	2·6	7·5
6 Super 3 cwt plus sulphate of ammonia 2 cwt plus sulphate of potash 2 cwt.	5·0	2·6	7·6

4. *J. Cooper, Croydon (Southland).*

Variety: King Edward. Date planted: 19th October, 1932. Twenty replications. Previous crops: 1931 32, turnips; 1930, grass. Crop dug and weighed: 5th July, 1933.

Table 4 —Results of J Cooper's Experiment

Treatment per Acre	Yield in Tons per Acre		
	Table	Seed.	Total
1 Super 3 cwt	3·9	3·5	11·1
2 Super 3 cwt plus sulphate of potash 1 cwt	4·1	3·7	11·3
3 Super 3 cwt plus sulphate of ammonia 1 cwt plus sulphate of potash 1 cwt	4·8	4·0	12·3
4 Super 3 cwt plus sulphate of ammonia 1 cwt plus sulphate of potash 2 cwt	4·7	4·3	12·3
5. Super 3 cwt plus sulphate of ammonia 2 cwt plus sulphate of potash 1 cwt	4·8	4·3	12·8
6. Super 3 cwt plus sulphate of ammonia 2 cwt plus sulphate of potash 2 cwt	4·7	4·2	12·2

5. *S. Kokay, Tuatapere (Southland).*

Variety: Up to Date. Date planted: 13th October, 1932. Twenty replications. Previous crop: 1931–32 and 1930–31 turnips after stumping. Crop dug and weighed: 24th May, 1933.

Table 5. Results of S Kokay's Experiment

Treatment per Acre	Yield in Tons per Acre.		
	Table.	Seed	Total
1. Super 3 cwt.	1·3	2·3	4·6
2. Super 3 cwt. plus sulphate of potash 1 cwt	1·3	2·6	5·1
3. Super 3 cwt. plus sulphate of ammonia 1 cwt. plus sulphate of potash 1 cwt.	1·2	2·8	5·2
4. Super 3 cwt. plus sulphate of ammonia 1 cwt. plus sulphate of potash 2 cwt.	1·6	2·8	5·5
5. Super 3 cwt. plus sulphate of ammonia 2 cwt plus sulphate of potash 1 cwt.	1·6	3·2	6·1
6. Super 3 cwt. plus sulphate of ammonia 2 cwt. plus sulphate of potash 2 cwt.	1·6	3·0	5·7

Results of Type B Experiment.

Particulars and yields of the Type B experiment were as follow:—

6. *High School, Rangiora.*

Variety: Aucklander Short Top. Date planted: 19th October, 1932. Previous crops: 1931–32, wheat; 1930–31, wheat; 1929–30, potatoes. Crop dug and weighed: 15th March, 1933. Twenty-one replications.

Summary of Yields

Treatments.	Yields in Tons per Acre.		
	Table.	Seed.	Total.
1. Super 3 cwt.	1·2	4·8	6·0
2. Super 5 cwt.	1·4	5·0	6·4
3. Super 5 cwt. plus sulphate of ammonia 1 cwt.	1·8	5·9	7·7
4. Super 5 cwt. plus sulphate of ammonia 2 cwt.	2·0	6·1	8·1
5. Super 5 cwt plus sulphate of ammonia 2 cwt. plus sulphate of potash 1 cwt.	2·1	6·0	8·1

There were only ten replications of the comparison super 3 cwt. versus super 5 cwt., and the differences between these treatments were not significant.

Other differences are embodied in Table 7.

Table 7.—Summary of Differences between Treatments in Type A and Type B Experiments showing (A) Effect of Nitrogen, and (B) Effect of Potash.

Treatments compared. (For explanation of abbreviations see footnote.)*	Differences in Tons per Acre in each Experiment. (Number as in text.)					
	1.	2.	3.	4.	5.	6 †
A. EFFECT OF NITROGEN.						
A1. Effect of First Hundredweight of Sulphate of Ammonia—						
Increase of P_2N_1 over P_2—						
Table	0·1	0·0	0·4	..	..	**0·4**
Seed	**0·6**	0·1	0·1	..	.	**0·9**
Total	**0·7**	0·1	0·5	..	..	**1·3**
Increase of $P_2K_1N_1$ over P_2K_1—						
Table	..	..	..	**0·7**	−0·1	..
Seed	..	..	..	0·3	0·2	..
Total	..	..	..	**1·0**	0·1	..
A2. Effect of Second Hundredweight of Sulphate of Ammonia—						
Increase of $P_2K_1N_2$ over $P_2K_1N_1$—						
Table	0·2	0·0	0·2	0·0	0·4	0·2‡
Seed	−0·1	0·0	0·0	0·3	**0·4**	0·2
Total	0·1	0·3	0·2	0·5	**0·9**	0·4
Increase of $P_2K_2N_2$ over $P_2K_1N_1$—						
Table	0·4	0·1	−0·3	0·0	0·0	..
Seed	0·0	0·1	0·1	−0·1	0·2	..
Total	0·4	0·2	−0·2	−0·1	0·2	..

Table 7.—Summary of Differences of Treatments, &c.—continued.

Treatments compared. (For explanation of abbreviations see footnote.)*	Differences in Tons per Acre in each Experiment. (Number as in text.) 1.	2.	3.	4.	5.	6.
B. EFFECT OF POTASH.						
B1. Effect of First Hundredweight of Sulphate of Potash—						
Increase of P_3K_1 over P_3—						
Table	..	..	.	0·2	0 0	
Seed		.		0·2	0·3	..
Total		.		0·2	0·5	..
Increase of $P_3N_1K_1$ over P_3N_1—						
Table	0·0	0 2	0·1	.	..	0
Seed	0 1	0·1	-0·1	.	.	-0
Total	0 1	**0 4**	0 0			0 1
B2. Effect of Second Hundredweight of Sulphate of Potash—						
Increase of $P_3N_1K_2$ over $P_3N_1K_1$—						
Table	-0·2	0·0	**0·6**	-0 1	**0 4**	.
Seed	0 0	-0 1	-0 1	0 3	0 0	.
Total	0 2	-0·1	**0 5**	0·0	0·3	.
Increase of $P_3N_2K_2$ over $P_3N_2K_1$—						
Table	0 0	0 1	0 1	-0·1	0 0	.
Seed	0 1	0·0	0 0	-0·1	-0·2	.
Total	0 1	-0·2	0 1	-0·6	-0·4	..

Figures preceded by a minus sign (-) signify *decreases*. Increases printed in heavy type are statistically significant

* The symbols P, K, and N refer to super, sulphate of potash, and sulphate of ammonia respectively. The figure given after each symbol represents the quantity in hundredweights of the fertilizer applied, thus $P_3N_1K_2$ represents super 3 cwt. plus sulphate of ammonia 1 cwt plus sulphate of potash 2 cwt

† In this experiment 5 cwt. super was used

‡ Increases of super plus sulphate of ammonia 2 cwt over super plus sulphate of ammonia 1 cwt.

Comments on Table 7.

Effect of Nitrogen.—In two experiments, Nos. 1 and 6, 1 cwt. of sulphate of ammonia added to super has had the effect of increasing yield significantly although in the first mentioned this only occurred in seed and total potatoes.

In experiment 4 sulphate of ammonia at 1 cwt. added to super plus potash has increased the yields of table and total potatoes significantly.

The yields of seed and total show significant increases by the addition of a further 1 cwt. sulphate of ammonia to super plus sulphate of ammonia 1 cwt. plus sulphate of potash 1 cwt. in Experiment 5, although in the same experiment 1 cwt. of sulphate of ammonia added to super plus potash had little effect.

Effect of Potash.—1 cwt. sulphate of potash added to super plus 1 cwt. sulphate of ammonia gave a significant increase in total potatoes in the case of Experiment 2. The addition of a further 1 cwt. sulphate of potash to super plus 1 cwt. sulphate of ammonia plus 1 cwt. sulphate of potash gave a significant increase in table and total potatoes in Experiment No. 3 and in table potatoes in Experiment 5.

SUMMARY.

The results of six experiments on the manuring of potatoes conducted in the South Island during the season 1932-33 are given.

In one experiment in which super at 3 cwt. per acre was compared with no manure, the former caused a significant increase in yield of 1·4 tons table, 0·6 tons seed, and 2·0 tons total potatoes.

Super at 5 cwt. per acre was compared with super 3 cwt. in one trial. Increases in favour of the former, however, were not significant.

Sulphate of ammonia at 1 cwt. per acre used as an addition to super in four trials gave a general average increase over super alone of about 4 cwt. table, 8 cwt. seed, and about 13 cwt. total potatoes. Differences were significant in only two of the trials, however.

Two experiments were designed to test the effect of using 1 cwt. sulphate of ammonia as an addition to super plus potash and in one of these significant increases in table and total potatoes were obtained. The use of 2 cwt. sulphate of ammonia in a complete fertilizer resulted in a significant increase in yield over 1 cwt. sulphate of ammonia in only one experiment out of five.

Sulphate of potash at 1 cwt. per acre gave no significant increases in the two trials in which it was used as an addition to super alone, and of four experiments in which 1 cwt. of sulphate of potash was added to super plus sulphate of ammonia in only one was a significant increase obtained, and then only in total potatoes.

When 2 cwt. of sulphate of potash was used in comparison with 1 cwt. in a complete fertilizer significant increases from the larger quantity were obtained in two experiments, although such increases were confined to the mixtures containing the smaller quantity (1 cwt.) of sulphate of ammonia.

Thanks are due to the farmers who co-operated in carrying out the foregoing experiments. The field-work in connection with the trials was carried out under the direction of Mr. R. McGillivray, Fields Superintendent, Christchurch, and Mr. R. B. Tennent, Fields Superintendent, Dunedin, by the following instructors: G. G. Calder, Christchurch; E. M. Bates, Ashburton; W. C. Stafford, Timaru; W. Faithful, Gore; and A. A. Hume, Invercargill.

A. W. Hudson, Crop Experimentalist.
J. W. Woodcock, Assistant Crop Experimentalist.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

WORK IN 1932-33 SEASON.

R. P. CONNELL, Fields Division, Department of Agriculture, Palmerston North.

APPARENTLY because of their intrinsic worth, the Boys' and Girls' Agricultural Club organizations are standing splendidly the test of the current difficult times. This is indicated to some extent by the following facts:—

1. In the season 1932–33 throughout the Dominion 255 more entries were judged than in the season 1931–32 in which more entries were judged than in any previous year.

2. In every administration district in which clubs function there was an increase in the number of entries judged. The number of entries judged in recent years is indicated in the following table :—

District.	Season 1931–32.			Season 1932–33.		
	Crops.	Stock.	Total.	Crops.	Stock.	Total.
Wellington - Taranaki - Hawke's Bay	705	1,481	2,186	659	1,607	2,266
Canterbury	65	20	85	76	102	178
Otago-Southland	393	238	631	463	250	713
	1,163	1,739	2,902	1,198	1,959	3,157

1. Wellington - Taranaki - Hawke's Bay Area.

In the Wellington-Taranaki-Hawke's Bay area an appreciable decrease in crop entries was offset by a greater increase in stock entries, with the result that there was a net increase of eighty entries judged. The prime cause of the decrease in crop entries was a reduction in the assistance which the Department of Agriculture was able to give the club work, associated with the view that the limited assistance available would go further in work relative to stock than in work relative to crops. The rapid development of the calf club activities is reflected in the fact that, while 651 entries were judged in 1929, the number judged in 1932 was 1,607.

The entries judged in the calf club competitions in the area during the past two seasons were :—

District.	Season 1931–32.	Season 1932–33.
North Taranaki	288	309
South Taranaki	524	418
Wanganui - Main Trunk	190	192
Manawatu	227	231
Horowhenua	59	114
Hawke's Bay	92	140
Wairarapa	101	203
Totals	1,481	1,607

The completed entries in crop competitions in the same area were :—

District.	Season 1931–32.	Season 1932–33.
North Taranaki	36	58
South Taranaki	217	197
Wanganui - Main Trunk	148	192
Manawatu	241	154
Wairarapa	28	..
Southern Hawke's Bay	35	58
Totals	705	659

In addition, a cow-judging competition conducted in South Taranaki attracted 222 entries, and in Manawatu a calf-judging competition, at the championship fixture, attracted 35 competitors.

Crop Competitions.

North Taranaki.

The fifty-eight entries judged were made up as follows: Mangels, 40; carrots, 13; swedes, 5.

The heaviest crop of mangels was grown by Phyllis Baker, Pukearuhe, with a yield of 152 tons 16 cwt., the variety grown was Prizewinner.

Three varieties of carrots were grown: Guerande, White Belgian, Holmes Improved. The heaviest crop was grown by Richard Purdie, Pukearuhe, with a yield of 52 tons 1 cwt. of Matchless White variety.

The swede crops generally were not good, there being considerable neck development and dry rot visible on the roots. The winning crop was grown by Esma Thomason, Egmont Village, and yielded 41 tons 6 cwt. per acre.

South Taranaki.

The entries judged were: Mangels, 62; carrots, 56; vegetables, 46.

Two varieties of mangels were grown in each plot for the purpose of a variety trial. The varieties were Prizewinner Yellow Globe and Orange Globe. The sixty-two plots judged gave the following average results: Yellow Globe, 78 tons 3 cwt. per acre; Orange Globe, 69 tons 13 cwt. per acre.

The average yield of both varieties shows the splendid figure of 73 tons 18 cwt. per acre, which is a record average for the competitions, the previous record being 71 tons 19½ cwt. established in 1928–29. The heaviest crop was grown by L. Gulliver, Whakamara, and yielded 158 tons 5 cwt. per acre.

This season a variety trial was conducted on the carrot plots, each being sown with two varieties—namely, Guerande and 100 Ton White. The Guerande carrots were not thinned, and the average yield from this variety was 42 tons 18 cwt., while from the 100 Ton White it was 40 tons 19 cwt. The average yield of both varieties shows the figure of 41 tons 18 cwt.

The heaviest crop of Guerande was grown by D. Gulliver, Whakamara, and yielded 78 tons 8 cwt. per acre. Norman Langlands, Auroa, grew the heaviest crop of 100 Ton White—yield, 61 tons 7 cwt. per acre.

In the vegetable competition forty-six entries, mainly drawn from the pupils attending the town schools, were judged. The crops selected were carrots, parsnips, beetroot, table swedes, silver beet.

Manawatu.

A total of 154 mangel plots were presented for final judging. Three existing records in this competition were broken during the season. The existing yield per acre for the district was exceeded in two instances by M. Lind, Rongotea School (163·5 tons per acre), and by P. Petersen, Makino (151 tons per acre). The number of plots, thirteen, which reached the 100 ton per acre mark, is a record. The average of 67·5 tons is the highest average yield per acre reached in the competitions. The performance of M. Lind won him the Stuart Wilson Cup.

TOP.—A GENERAL VIEW OF THE HOROWHENUA CHAMPIONSHIP GATHERING, 1933, AT LEVIN

CENTRE.—WINNING GROUP, HOROWHENUA ASSOCIATION, 1933, SHANNON SCHOOL.

BOTTOM.—A CALF CLUB CLASS AT MANAWATU-OROUA CHAMPIONSHIPS, PALMERSTON NORTH.

Southern Hawke's Bay.

In the mangel-growing competition forty-three entries were judged. The average yields of the varieties grown were: Prizewinner Yellow Globe, 54 tons 1 cwt.; Red Intermediate, 50 tons 2 cwt.; Long Red, 44 tons 18 cwt. The average for the plots was 49 tons 14 cwt. The heaviest crop, that of Phylp McCulloch, yielded 106 tons 14 cwt. per acre.

Wanganui.

The total entries received numbered 155, comprising: mangels, 76; swedes, 33; carrots, 46.

The average yield per acre of mangels was 62 tons. The heaviest crop was grown by B. Schwass, Alton, yielding 119 tons per acre. The average yield of swedes was 50 tons per acre. The heaviest crop was grown by H. Amon, Manutahi, and yielded 65¼ tons per acre

The average yield of carrots was 28 tons per acre. The heaviest crop was grown by N. Blackie, Waitotara, and yielded 53 tons per acre.

CALF CLUB CHAMPIONSHIPS.

The championship winners in the various districts were:—

District	Class	Winner.
Wanganui	Open	E. Sims.
Manawatu	Dairy type	Wm. Scott.
	Rearing and attention	Molly Slattery.
Wairarapa	Dairy condition	Arnold Goss.
	Dairy type	Arnold Goss
Horowhenua	..	Edith Close.
Southern Hawke's Bay	Dairy type	Alan Arrow
	Dairy condition	Tom Upston
South Taranaki ..	Dairy condition, Jersey/Ayrshire	Phyllis Stallard
	Dairy type, Jersey/Ayrshire ..	Gwen Nicholson
	Dairy condition, Shorthorn/Friesian	Peter Gould.
	Dairy type, Shorthorn/Friesian ..	Ethel Newlove
	Two-year-old in milk	Myra Wren
North Taranaki ..	Jersey/Ayrshires—	
	Condition	Pat. Locke.
	Dairy type	Phyllis Baker.
	Shorthorn/Friesian	
	Condition	Martin Rea
	Dairy type	Lily O'Byrne
	Pedigree Jersey—	
	Condition	Douglas Hale
	Dairy type	Keith Hammond.
	Pedigree Ayrshire—	
	Condition	Lorna Ashman.
	Dairy type	Florrie Stanley.
	Pedigree Friesian—	
	Condition	Ron O'Byrne.
	Dairy type	Ron O'Byrne.

2. Canterbury Area.

The following table summarizes the work in the boys' and girls' clubs during the past two seasons:—

Competition.	Entries judged.	
	1931–32 Season.	1932–33 Season.
Potatoes	65	68
Mangels	..	8
Calves	20	31
Poultry	..	71
	85	178

A new feature was the work with poultry clubs which, introduced as an experiment, attracted favourable attention. It is felt that the experience being gained in the carrying-on of calf and crop competitions will lead to future expansion in the club work.

The principal results were :—

(a) Potato championship -Sutton's Cup : Annabelle Gray.
(b) Best calf : B. Graham.
(c) Best poultry project : T. Woodfield.

3. Otago and Southland Area.

In the Otago and Southland area the entries both in the crop and stock competitions increased.

Otago.

Calf Competitions.

A total of 100 calves was judged in comparison with 98 in the previous season The championships were won by—

Friesian : Max Dick, Weston.
Jerseys : Nancy Goodlet, Wakari.
Shorthorns : Jean Tisdall, Ngapuna.
Ayrshires : A. Gillies, Hampden.

Crop Competitions.

A total of 287 entries was judged, this being a substantial increase over the 200 entries judged in the previous season. The results are summarized in the following table :—

Competition.	Number of Crops finally weighed	Average Yield per Acre		Highest Yield per Acre.	
		Tons.	cwt.	Tons.	cwt.
Potato	165	16	0	41	3
Chou moellier	10	39	2	66	0
Carrot	91	20	14	69	10
Mangel	21	54	13	112	10

The principal awards were :—

Championship : Thomas Landreth, Katea School (95½ points).

Special awards—

Most points in field-work : J. Robinson, Waitaki Boys' High School (49 points ; maximum, 50).

Most points in record-keeping : Thomas Landreth, Katea School (29 points ; maximum, 30).

Southland.

Calf Competitions.

A total of 140 calves was judged in 1932–33 in comparison with a total of 122 in 1931-32. The 1932–33 principal awards were won by—

Invercargill Show Championships—

Large Breed, Friesian-Shorthorn class : John McBride, Mimihau School.

Small Breed, Jersey class: Gilbert Mortimer, Makarewa.
Small Breed, Ayrshire class: T. Muirhead, Waimatuku.
Championship: R. Hassed, Otautau.

Pig-feeding Competitions: An interesting pig-feeding competition, which will be described in a separate report, was also conducted.

Crop Competitions: In the crop competitions the completed entries were 176, in comparison with 193 in the previous season. The results are summarized in the following table:—

Crop	Number of Crops judged	Average Yield		Highest Yield.	
		Tons.	cwt	Tons	cwt.
Potatoes	75	18	8	42	3
Chou moellier	13	36	8	63	0
Carrots	77	16	4	47	5
Mangels	11	63	10	105	4

The principal awards were -

Potato-growing (variety, King Edward)—

Intermediate division—

Championship: Ritchie Hassed, Otautau (95 points).

Special awards—

Most points in field-work (maximum, 50): James Robertson, Winton District High School (50 points)

Most points in record-keeping (maximum, 30): Mervyn Hamilton, Lora Gorge School (27¾ points).

Chou moellier growing (variety: Green Stem)—

Intermediate division—

Championship: Eileen Hassed, Otautau (93¼ points).

Special awards—

Most points in field-work: Alex. Buchanan, Browns School (49½ points).

Best record-keeping: Eileen Hassed, Otautau (27¼ points).

Carrot-growing (variety, Red Intermediate)—

Junior division—

Championship: Bessie Nicholson, Isla Bank School (90¾ points).

Special awards—

Most points in field-work: Ella Valli, Waimahaka School (50 points).

Most points in record-keeping: John Robertson, Winton District High School (24½ points).

Mangel-growing (variety, Prizewinner Yellow Globe)—

Championship: Walter Hassed, Otautau School (90¼ points).

Special awards—

Most points in field-work: Allan Lapthorne, Browns School (50 points).

Most points in record-keeping: Linda Evans, Long Bush School (25½ points).

REGISTRATION OF FERTILIZERS IN 1932-33.

J A. BRUCE, Inspector of Fertilizers, Department of Agriculture, Wellington.

ONE of the principal objects of the Fertilizers Act, 1927, is to inform the primary producer of the true plant-food content of the numerous types of commercial fertilizers. This object is attained by compelling vendors to guarantee the quality and to disclose any filler that they might use in the fertilizers they sell.

True and accurate specifications of every brand of fertilizer sold in any quantity of 5 cwt. or more are required to be registered each year in June with the Director-General of Agriculture or, in the case of a new fertilizer, before being offered for sale. When he has secured a certificate of registration of the brand, the manufacturer, importer, or brand-owner may offer his fertilizer for sale. The retailer or secondary vendor may also proceed with the selling of fertilizers after he has received a notification that such brand is in order and has been registered by the manufacturer or other principal vendor responsible for the quality of the article placed on the market.

On the sale of 5 cwt. or over of the fertilizer, the vendor or his agent must ensure that the purchaser is supplied with an invoice certificate in which the registered brand and plant-food content, &c., is declared in accordance with the specifications given in the sworn statement filed with the Department. Any vendor failing to supply a purchaser with the correct invoice certificate is liable to prosecution. The purchaser, moreover, has the right to refuse acceptance of the fertilizer delivered to him if the bags are not properly branded or the correct invoice certificate is not forthcoming.

The statutory control exercised over the quality of fertilizer is very necessary. Few realize the magnitude of the fertilizer industry in this Dominion and the large amount of material that is used throughout the country. For instance, during the twelve months ended 15th October, 1932, it is estimated that roughly 437,000 tons of fertilizer were used on farms in New Zealand. Of late years the annual production of superphosphate alone has been in the vicinity of a quarter of a million tons, and the sale of mixed fertilizers runs into many thousands of tons each year In addition, during the year ended 31st March, 1932, for example, the meat freezing and preserving and boiling-down works together produced 30,950 tons of manure. This figure, however, includes mixtures of by-product fertilizer with superphosphate, rock phosphate, and other fertilizers, and therefore covers more than the actual production of the works. The number of primary fertilizer vendors registered—*i.e.*, those selling under their own brands—was 282, this including various branches of certain firms. Secondary vendors registered totalled 415.

The principal fertilizer used in New Zealand is superphosphate. which is produced by eight works operating throughout the Dominion. Superphosphate is manufactured from rock phosphate, chiefly from Nauru and Ocean Islands, and sulphuric acid which also is produced at the works. Large quantities of sulphur are imported from foreign

countries for its manufacture. The greater bulk of the nitrate of soda brought into New Zealand from Chile appears to be used for this purpose.

According to official figures there were thirty-five meat-freezing and meat-preserving works operating in the Dominion during the year ended 31st March, 1932, and thirty-two boiling-down works.

By-product fertilizers are the result of boiling down condemned carcasses, bones, blood, offal, &c., which are then dried and ground and placed on the market as fertilizer. Bonedust and blood and bone manure are the chief fertilizer products of the above establishments and are still very popular in New Zealand as constituents of mixed manures and with market-gardeners, orchardists, small growers, home gardeners, &c.

Judging by the large number of brands registered, it would appear that a good trade is carried on with mixed fertilizers—in fact, the number of registered brands on the market seems excessive when due consideration is given to the size of New Zealand in comparison with other countries. The total for 1932–33 was upwards of 1,650 distinctive markings. With greater standardization this number could be considerably reduced and this would lessen to some extent the present cost of manufacturing mixed fertilizers On the whole, the fertilizer registration position is now much more satisfactory than it has ever been previously since the registration of fertilizers was inaugurated many years ago. However, there is still room for improvement in the manner in which a number of applications are submitted. On many occasions it has been found necessary to return vendor's statements and to issue warnings regarding the sale of unregistered or incorrectly described fertilizers. Attention of vendors has repeatedly been drawn to the necessity of supplying correct invoice certificates to all fertilizer consumers on the sale of every 5 cwt. or more of fertilizer.

No doubt the system of selling fertilizers in New Zealand is a great advance on what was formerly in vogue, and is probably better than in some other parts of the Empire. Certainly the use of filler has been reduced to a minimum, New Zealand being ahead of most other countries in making vendors declare the nature and amount of filler in their fertilizers. The analyses of fertilizers since the 1927 Act was passed have risen substantially all round.

Some undesirable practices, however, especially in regard to the improper advertising of fertilizers by a certain class of vendor, still persist and are apt to act as a drag on the trade, hindering the expansion of the proper and economic use of the various classes of fertilizers, so essential to a prosperous agriculture in the Dominion. The good work of instructional and advisory officers connected with fertilizer practice is often undermined by propaganda of the wrong type which is widely distributed at frequent intervals. There is, too, the antiquated custom of advertising plant-food as equivalent to some associated chemical compound, which, besides serving to confuse purchasers, is not at all applicable to some of the newer class of synthetic preparations such as phosphate of ammonia and concentrated superphosphate, the sale of which is gradually extending in several parts of the world. Many instances of this antiquated marketing practice can be quoted—for example, even high-grade superphosphate, which is usually

advertised to contain 44-46 per cent. soluble phosphate, contains actually about 34 per cent. monocalcium phosphate or water-soluble phosphate which is equivalent to 44–46 per cent. tricalcium phosphate (insoluble in water). The standard term, phosphoric acid, as specified by the Act, should be employed for all phosphatic fertilizers, and in the case of the high-grade local superphosphate this amounts to about 20 per cent. Basic slag is usually advertised in this country under a grade mark representing its average or range content of phosphoric acid—*e.g.*, 15 per cent., 17–20 per cent., or 20–22 per cent., as the case may be—and not so often on its equivalency to tricalcium-phosphate—like superphosphate. As in the case of slag, a vendor who rightly chooses to adhere to the standard terminology and procedure laid down by the Fertilizers Act when taking orders or advertising rock phosphate for sale is placed at a disadvantage when other vendors adopt the system of expressing the quality of their phosphates in the higher terms of tricalcium phosphate. For instance, some vendors advertise North African phosphate as a 26–29 grade (phosphoric acid) while others adopt the higher numerals 58-63 (tricalcium phosphate) for this same grade. The position is similar in respect to nitrogenous and potassic fertilizers. It is still quite common to see fertilizers containing nitrogen including even blood and bonedust, &c., the nitrogen of which is not in ammoniacal form, advertised to contain so much ammonia instead of nitrogen, and in the case of potassic fertilizers as containing so much sulphate of potash instead of actual pure potash (K_2O). All this is very confusing to the farmer, and provision is urgently needed for a compulsory adherence to standard methods of description. In certain other fertilizer-consuming countries each individual fertilizer on the market is specifically defined in a schedule embodied in the fertilizer law, and all statutory statements, markings on packages, and advertisements embodying claims of quality must be in strict accord with the prescribed standards.

For a number of years the Association of Official Agricultural Chemists in the United States of America has been formulating definitions of terms and materials and striving to bring about greater uniformity in the expression and interpretation of results of fertilizers; the purpose behind this being a clarification of terms so that buyers and sellers may talk the same language.

With many mixtures, particularly those of lime and superphosphate, the practice has occasionally been noted whereby the analyses are merely calculated on the basis of the proportions in which the various components occur, no account being taken of any possible chemical reactions which may take place between the various ingredients. Such mixtures are often-times declared to contain soluble phosphoric acid in much greater amount than in which it actually occurs, and registration of such mixtures has had to be refused because they were guaranteed to contain soluble phosphoric acid whereas there was practically no water-soluble phosphoric acid present.

It is fortunate in one way that to-day it is being more fully realized by the community as a whole that the manufacturing and mixing of fertilizers is essentially a highly specialized chemical industry which must be under strict regulation or supervision if products of the desired or correct composition are to find use in the intelligent and economic feeding of soil and plants.

The problem of the consumer is always a difficult one; for even if he has made up his mind on particular plant-foods for his soil or crops he has still to find out what combination of quick-acting plant-foods with more slowly acting ones will be the most economical and otherwise satisfactory for his particular purpose on the farm. On the other hand, in spite of the great problems and the disappointing conditions of agriculture at the present time, some consolation may be taken from the fact that generally prices of fertilizer are very much lower than formerly, and, furthermore, there is a far greater fund of information available to the farmer than ever before; his main fertilizer problems are rendered less difficult now than was the case not so long ago even though of course a tremendous amount has still to be found out in regard to what happens to fertilizer after it is distributed on the land. As far as the purchase of fertilizer is concerned, however, there is not so much excuse now for this class of commodity to be either bought or sold blindly.

Unfortunately, in the past buyers have shown very little discrimination in accepting particulars of fertilizers which were not registered, and which were entirely lacking in information as to their branding, composition, and source. Under the present Act, every buyer should at least have the assurance that the products delivered to him are reliable and of the composition stipulated. It is therefore highly desirable that a sample of every brand of fertilizer sold in any appreciable quantities in the Dominion should be annually sampled by an Inspector, analysed, and results published in pamphlet form as is usually done elsewhere. The analysis can also be checked with the registered particulars or invoice certificate of the vendor, and appropriate action taken if the guarantees are not substantially met by those responsible.

As the vendor's guarantee must be given on the invoice certificate, the farmer is enabled to note whether the guarantee given is in accord with that under which he purchases the fertilizer. In special circumstances it is his right also under the Act to have the fertilizer sampled by an Inspector and examined. If it is found deficient in the guarantee of plant-food content, the buyer would by arrangement with the vendor be entitled to a rebate of the difference between the relative commercial value based on the analysis and the actual price paid for the material. This is apart from any legal proceedings which may be instituted under the Act. A point of great importance which should be borne in mind when fertilizers are bought, especially if being carried long distances, is that *purchase should be made on the basis of the value of the plant-food they contain and not on the bulk which may be had for a certain price.* In other words, the price per ton of any fertilizer is no indication of its relative cheapness unless reference is made to its fertilizing values. An article on the Choice and Purchase of Fertilizers appearing in the April, 1933, issue of the *N.Z. Journal of Agriculture* gives in broad outline the general procedure which may be adopted to advantage when buying fertilizer.

The urgency for official analysis of fertilizer is particularly apparent in cases where fertilizers are sold in bulk (unbagged) which in these times of financial stress is naturally becoming an increasingly popular

means of selling with the purpose of economizing on bags. In large transactions of this nature one or two or more firms may send anything up to 5,000 tons of a certain fertilizer—*e.g.*, phosphate—under a stipulated guarantee of quality in lots of, say, 5 to 100 tons or more to merchants, farmers, and dairy companies. Without chemical analyses of a number of suitably chosen samples from all parts of the shipment, there is no reliable check, and if the guarantee were deficient on the greater bulk of the material to the extent of, for example, 2 per cent. (two units) this would mean a loss to the farmers using the material of some thousands of units of plant-food valued perhaps at 3s. a unit. There is always, of course, the possibility of the consignment not being of uniform quality throughout—for instance, the moisture content may vary considerably in different parts of a shipment and some purchasers might be placed at a disadvantage in buying and transporting material which is not of the plant-food content they contracted to get. If suspicions were aroused as to the value of the guarantee, by the time arrangements were made at headquarters for official samples to be taken, the stocks of the fertilizer might well be disposed of. It is therefore necessary for sampling officers to be at the ship's side immediately it arrives.

Several cases have also come under notice where various fertilizers are sold with a branded guarantee which is not in accord with the invoice certificate guarantee. Sulphate of ammonia, for instance, carrying a brand embodying a claim of 20·6 per cent. nitrogen has at times been guaranteed to contain only 19 per cent. of nitrogen (a difference of 1½ units valued at about 10s. per unit) in the registration statement and invoice certificate. In cases like this samples must always be obtained and analysed to ascertain the true position before suitable action is taken.

To any one who has closely studied the various classes of fertilizers on the market in New Zealand the great number of differently named and branded mixtures is indeed a revelation. As has been pointed out on many previous occasions, two mixed fertilizers carrying distinctive crop names may differ by ½ or perhaps 1 per cent. in guaranteed plant-food content, and in other cases one fixed fertilizer formula will be offered for sale under several different names such as "rape, grass, orchard, and potato" manure for crops having widely different nutritional requirements. It can easily be understood that a multiplicity of brands as is evidenced in a small country like New Zealand, is most uneconomical from the point of view of their preparation, branding, and distribution. Standardizing of mixtures from experimental data published by or on record at the Department of Agriculture and various research institutions should be taken advantage of more freely by both manufacturers and merchants.

Improvement in the advertising of fertilizers generally is a matter of great importance which in the opinion of not a few is best tackled by constantly educating the farmer and fertilizer salesman in matters relating to soils and fertilizers.

In practically all countries where fertilizers and soil amendments such as lime are employed to any extent, various scales of charges are made to principal vendors, manufacturers, importers, &c. An extract from a summary of the financial statement of the Fertilizer Control

Fund of the Missouri Agricultural Experiment Station for the year ended 31st December, 1930, is quoted as being typical of the position in many States of America :—

	Dollars.
" Receipt from sale of tags	27,765
Total expenditure (including salaries, &c) .. .	22,477
Net revenue	5,288 "

It is interesting to note that the total sales of fertilizer in Missouri for that year were only 51,880 tons.

There is no doubt that with suitable amendments to the present Fertilizers Act and the carrying-out of the proposals of the National Expenditure Commission to charge a reasonable and equitable scale of fees to brand-owners for registration of brands, a more efficient regulation of the trade for the betterment of fertilizer industry and agriculture should be secured. It would not be altogether satisfactory to consider the subsidizing of all classes of fertilizers as in Australia until a reduction in the innumerable brands on the market is obtained ; and a means to this end is the charging of appropriate registration fees to secure a limitation or reduction of brands

With the rapidly extending use of all types of fertilizers by home gardeners, small growers, market-gardeners, &c., throughout the Dominion, it is a matter of considerable moment that due consideration be given to the question of placing the sales of quantities of fertilizer up to 5 cwt. under some sort of control so that the purchaser may be in a position to know that he is getting value for the money he spends. It should be quite obvious to all that in the case of a substance like fertilizer, which must be bought entirely on its analysis, a close check is necessary on its quality. The purchaser is entitled to the utmost protection and to feel that he can use the goods he is purchasing with every confidence to get the results desired.

NOTES ON RECENTLY OBSERVED EXOTIC WEEDS.

H H ALLAN, Botanist, Plant Research Station, Palmerston North.

(6) Saffron Thistle and Marsh Thistle.

Carthamus lanatus synonym *Kentrophyllum lanatum* (Saffron Thistle).—This thistle has its native home in Europe, especially the Mediterranean region, and in North Africa. It affects stony sunny localities and dry pastures, and is a close relative to the safflower (*C. tinctorius*), but lacks the properties that make that species useful for dyeing purposes. It is an annual plant, when well grown forming a prickly bushy mass up to 3 ft. in height. The upper parts are more or less clothed with spider-webby hairs, and the yellow flower-heads are surrounded with prickly leaves similar in shape and appearance to those of the stem, but closely clasping the head. This feature, together with the details shown in the illustration (taken from Volume 5 of the *Agricultural Gazette of New South Wales*) will serve to make its identification easy.

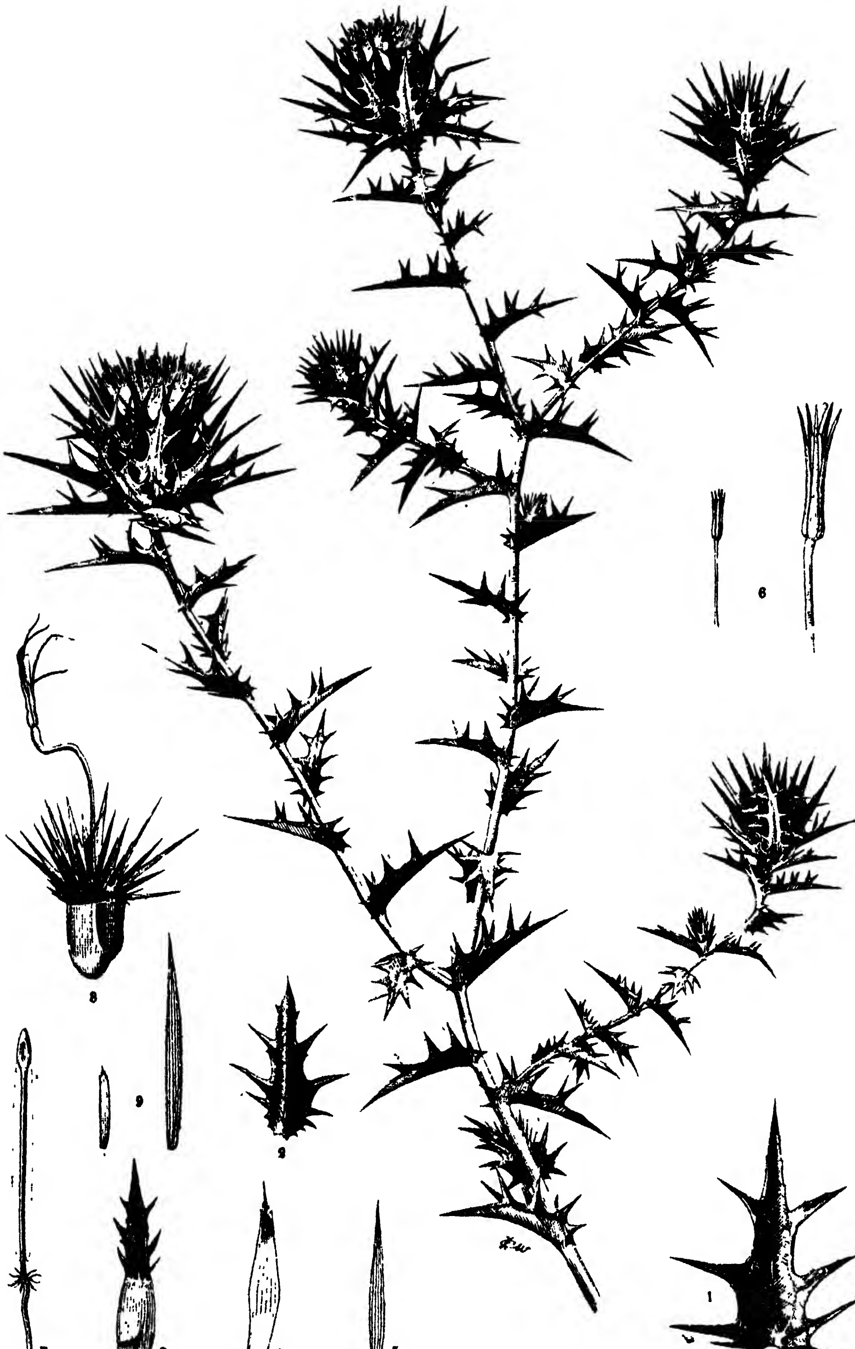

FIG 1. SAFFRON THISTLE.

1, leaf ; 2, 3, 4, 5, bracts of flower-head , 6, florets ; 7, anther, with bristly appendage ; 8, fruit, with stiff pappus, and withered floret , 9, pappus scale.

It was early naturalized in Australia, and in the States of South Australia, Victoria, and New South Wales has proved a great nuisance. The recommendations given for its control aie to cut and burn the plants before they come into full flower. No doubt sodium chlorate spraying in the early stages of growth would prove effective.

In New Zealand it has recently been observed by Mr. S. Freeman near Masterton, and by Mr. J. B. Hogg near Wanganui. In both places it appears to be infrequent, and steps should be taken to prevent its getting a hold. It has also been observed near Hamilton.

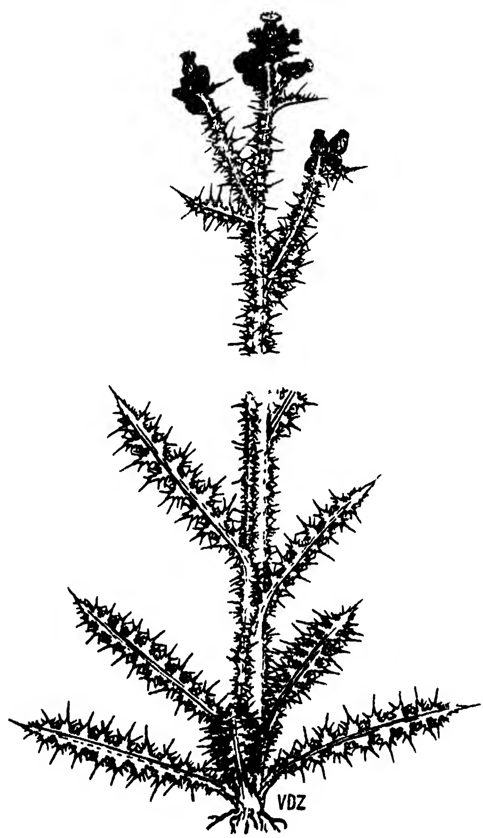

FIG. 2. MARSH THISTLE.

Cirsium palustre (Marsh Thistle).—This species is also called *Carduus palustris* and *Cnicus palustris*. The Second Schedule of the Noxious Weeds Act consists of a list of species that become " noxious weeds when so declared by local authority." In the terms of this schedule any species of *Carduus* or *Cnicus* may be declared noxious. Most modern taxonomists place the group of thistles concerned under two genera, but adopt the name *Cirsium* in place of *Cnicus*. Others use only the name *Carduus*, treating the cirsiums as a sub-genus. The question is a technical one, but is not altogether of academic interest

only, as the divergence of naming might create the possibility of legal argument in disputed cases. The " Californian " thistle is referred to in the First Schedule of the Act as *Cnicus arvensis,* but it is as well to point out that it is exactly the same species as is referred to by present-day botanists as either *Carduus arvensis* or *Cirsium arvense.*

Marsh thistle is a native of Europe and West Asia, found mainly in damp ground, and on the margins of streams and ponds. It is of tall, erect habit, usually with a single purplish-green stem, branching towards the top. The leaves are deeply divided, with numerous brownish prickles and a pale midrib. The leaf-margins bear purple-based spines. The stem is winged, and carries spinous rudimentary leaves. The flower-heads are somewhat egg-shaped, clothed with narrow bracts, and bearing purplish florets. It is a biennial, and in its first year shows a rosette of prickly leaves spreading over the ground, as does the common Scotch thistle.

In Europe it has given trouble in sour ground and damp pastures. As each plant bears some seven thousand seeds, it tends to spread rapidly in situations suitable to it. It is avoided by stock, whether in pasture or in hay. Drainage of the ground goes far to check its spread. Spraying should be effective where drainage is not an economic proposition.

In New Zealand it was reported as occurring in Westland and Southland in 1911, where it might be expected to give trouble. There does not, however, appear to be any further reference to it. Mr. V. D. Zotov has observed it established in damp pastures along the upper Tiritea Stream, near Palmerston North. It also occurs near Woodville.

(7) **Wild Onion,** *Allium triquetrum.*

This rather handsome relative of the onion is frequently grown in gardens, whence it has made its escape in a number of localities in the North Island. It readily establishes in cool, damp spots, and in recent years has proved aggressive. The strong onion-like odour renders it an unwelcome entrant into dairying land.

This Allium is a native of the Mediterranean region and of North Africa, and in Algeria is used as a vegetable, under the name " bibrous." Trabut recommended its cultivation in southern Europe, as a vegetable " *très fin et très interessant.*" Farrer also spoke of it as promising " to develop into a popular vegetable." This promise does not seem to have been fulfilled. Introduced into England towards the end of the eighteenth century, the plant finds favour as a member of the wild garden and for growing under trees. In certain parts of the southern counties it is now found as a hedgerow plant, and it also grows wild in Guernsey.

Allium triquetrum is a characteristic member of the lily family, and is easily distinguished from the other alliums by its triangular stems. The bulbs are about ¾ in. in diameter, with pale coats, and produce numerous offsets. The leaves are narrow, bright green, with white sheathing bases, and are 18 in. long or thereabouts. They possess a distinct keel, and the margins are at such an angle that the leaves appear in section as a triangle with slightly hollowed sides. The stems are also triangular in section, with acute edges and somewhat hollowed sides. The flowers are borne in stalked clusters at the tips of the stems.

At the base of each cluster is a spathe consisting of two delicate, pale, narrow valves that twist and point downwards as the flowers develop. In a well-grown plant there are about twelve flowers to a cluster, each on a slender spreading or drooping green stalk. The flower segments are about ⅓ in. long, six in number, white, with green midribs. There are six stamens and a three-celled ovary.

How aggressive this plant may be is shown by a case brought to my notice by Mr. R. O. Dalrymple, of Bulls, where a bed of periwinkle is being ousted by an upgrowth of a mass of the allium. Where once a plant gets a hold on dampish pasture land its control is a matter of great difficulty, as the bulbs may be well below the surface of the ground, and immune from sprays in ordinary strengths.

In 1899 Kirk recorded the " wild onion " or " sweet-scented garlic," *Nothoscordum fragrans*, an American plant, as " spreading in the warmer portions of the colony, and is not unlikely to become a very serious pest." This species does not appear to have been met with since. It is possible that the plant Kirk was referring to was really *Allium triquetrum*, but one would fain hope that attention was so promptly and thoroughly paid to Kirk's remarks that the sweet-scented garlic was cleaned out. Kirk observed : " In gardens the plant should be dug up, care being taken not to break the plant. Amongst grass it should be treated the same as Californian thistle — viz., kept shaved off level with the ground : with such treatment it will in a few seasons die out. If, however, wild onion once get possession of good land its eradication is very difficult ; therefore, tackle it on first appearance."

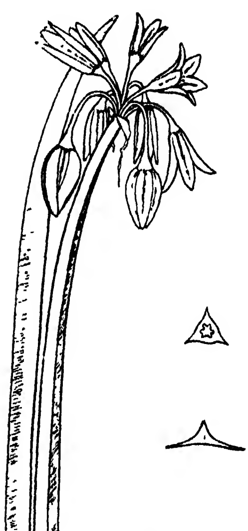

FIG. 3. WILD ONION.

On right : Above, section of stem ; below, section of leaf.

N. fragrans resembles *A. triquetrum*, but differs in the absence of the onion-like odour, the more numerous seeds in each cell of the ovary, and in the more greenish flowers with brownish midribs. A watch should be kept for it, but the treatment to be meted out is the same. Ewart, in " The Weeds, Poison Plants, and Naturalized Aliens of Victoria," gives the following recommendations : " The plant can best be suppressed by cultivation and by the growth of leafy fodder or root crops. The ground must be worked well between each crop, so that the bulbils are not allowed to develop. Two years' treatment will be necessary to suppress it fully. Poisons are useless. The plant is not itself poisonous, but is useless for fodder, and a great nuisance on grazing land." The recommendations of Wild (*New Zealand Journal of Agriculture*, Vol. 37, 1928, pp. 93–96) for the control of crow garlic (*Allium vineale*) are worth studying in connection with the present species, especially the question of heavy stocking of infected pasture. Korsmo suggests spraying dense growths with a 5-per-cent. sodium-chlorate spray. It is probable that several sprayings would be required to effect any real measure of control.

METHODS OF CYANIDING IN GLASSHOUSES.

ECONOMICAL CONTROL OF WHITE-FLY.

J. MUGGERIDGE, Entomologist, Plant Research Station, Palmerston North.

THE most economical way of dealing with infestations of white-fly in glasshouses (Speyer, 1929), apart from biological control methods, is by fumigation with hydrocyanic (prussic) acid gas. The gas is generated by dropping one part by weight of sodium cyanide (98 per cent. purity) into glass jars placed at regular intervals upon the paths of the house, each jar containing 4½ parts by volume of 33 per cent. sulphuric acid. One-fifth to one-quarter of an ounce of sodium cyanide gives off a quantity of gas into a space of 1,000 cubic feet sufficient to kill all the adult flies and about 90 per cent of the scale stages, but the eggs are not killed. A second fumigation is therefore necessary from a fortnight in warm to three weeks in cool weather after the first.

One-quarter of an ounce of sodium cyanide to the 1,000 cubic feet space is the maximum which can be used with safety upon most glasshouse plants, and as the gas is easily decomposed in the presence of light it is essential to start fumigation at dusk, and to air the houses thoroughly by opening the doors and ventilators at dawn. While no further precaution than the latter is called for in the case of plants with coarse or leathery foliage, the tender foliage of the tomato plant will not stand, without grave injury, concentrations of the gas sufficient to kill the scale stages of the insect, unless water is withheld from the roots for a considerable time before fumigation—that is to say, the plants to be fumigated must actually require watering when fumigation is started. Moisture upon the foliage, however, is of no concern. Cucumber and allied plants which require water continuously will not stand fumigation with a greater concentration of gas than is obtained from ⅛ oz of sodium cyanide to the 1,000 cubic feet space, an amount sufficient only to kill a good proportion of the adults, the eggs and scale stages being left alive.

Though prussic acid gas is extremely poisonous to man, there is no danger from the practice of cyaniding provided ordinary precautions are taken. The sodium cyanide should never be wrapped in paper or cardboard before being dropped into the acid. The ventilators should be closed and a door left open; the cyanide charge is then dropped into the acid, and the operator leaves the house comfortably, closing and locking the doors. On opening up at dawn the ventilators should first be opened from outside, but if this is not possible, the door or doors should be opened for twenty-five to thirty minutes before any attempt is made to enter the house to open the vents from inside.

It is inadvisable to fumigate on windy nights, as the gas is liable to become very unevenly distributed.

THE DRY METHOD.

The foregoing method, which is usually referred to as the jar method, is now apparently largely superseded by the dry method or

slow process generation of hydrocyanic acid gas. Directions for the adoption of this method are as follows:—

Dry powdered sodium bicarbonate and high-grade sodium cyanide (98 per cent. purity) in a fine state of division, are thoroughly mixed together in proportion of three parts sodium bicarbonate and one part sodium cyanide by weight.

One ounce of the mixture to every 1,000 cubic feet space is distributed upon the paths of the houses, which must be dry. As the generation of cyanide is slow, the operator can treat a considerable number of houses in a block single-handed.

The mixture should not be touched with the hands; when distributing, it should be shaken from a large tin, the operator walking backwards to avoid getting the powder upon his clothing. The ventilators may be opened during distribution, and closed immediately after. The houses should be locked up for the night.

The mixture should be distributed at dusk, water having been withheld from the plants, so that they require moisture at the root. Fumigation on rainy, but not necessarily on windy, nights is to be avoided. The ventilators should be opened from outside at dawn the next morning, and left open for not less than one hour. The residual sodium carbonate may be left on the paths. Heat may be put on during fumigation if conditions demand it.

APPOINTMENT OF DIRECTOR, LIVE-STOCK DIVISION.

CONSEQUENT upon the retirement of Mr. J Lyons, Mr W. C. Barry, M R C V S, has been appointed Director of the Live-stock Division of the Department of Agriculture For nearly the past eight years Mr Barry has been District Superintendent of the Department for the Wellington District, which includes Wellington, Hawke's Bay, Taranaki, Marlborough, and Nelson.

Mr. Barry came to New Zealand in 1915 as a Government Veterinarian and was first stationed at Christchurch with supervision over some of the Canterbury meatworks and the milk-supply of the City of Christchurch During the war he was engaged in active service with the New Zealand Expeditionary Forces in Egypt as a Captain in the Veterinary Corps, and on repatriation resumed his former activities in Christchurch. For some time he was lecturer on veterinary science at Canterbury Agricultural College, Lincoln. In 1921 Mr Barry proceeded to Auckland to fill a vacancy in the Department's veterinary service, and acted in the capacity of District Superintendent at Auckland for a few months prior to his transfer to a similar position in Wellington early in 1926.

Noxious Weeds Order.—The Waitomo County Council has declared hemlock (*Conium maculatum*) to be a noxious weed within its jurisdiction.

The reappointment by His Excellency the Governor-General of Mr. C. H. Hewlett as a member of the Board of Governors of Canterbury Agricultural College, is gazetted.

Special Orchard-tax payable in the Rangiora Fruitgrowing District.—By order issued in exercise of the powers conferred by subsection (3) of section 4 of the Orchard-tax Act, 1927, it is provided that, in addition to the general orchard-tax payable under section 3 of the said Act, the occupier of every orchard within the Rangiora commercial fruitgrowing district shall in each year be liable to pay a special orchard-tax calculated at the rate of 2s. for every acre or part of an acre comprised in his orchard and planted with apple-trees, pear-trees, or quince-trees.

SEASONAL NOTES.

THE FARM.

The Pastures.

OFTEN in January and February tall woody or fibrous growth, consisting largely of flowering organs, is prominent on many pastures. If this growth is not removed the plants on which it occurs devote themselves largely to seed-production, whereas if it were removed they would tend much more freely to produce leafage. At this season, both in dairying and in fat-lamb production, there is often an acute need for leafy feed. Hence topping of pastures with its consequent transference of the activity of the sward to leaf growth from seed-production is often advisable. If dry conditions seem likely to persist for any considerable time after such topping, it should be carried out at a height which will serve to remove the stemmy portions at the same time as the bottom leafy portions of the sward are undisturbed—this necessitates cutting at a considerably greater height than is adopted in ordinary mowing. Apart altogether from the occurrence of tall, stemmy growth, topping of pastures may be advisable to remove as completely as is possible, without exposing the swards to the danger of drying out, all the aerial portions of shade-creating weeds such as spear thistles, docks, fat-hen, and red-shank or willow-weed. If weeds of this type are not checked in some way they are likely to weaken greatly the pasture plants in their immediate vicinity, and possibly to create vacant patches on which inferior plants later may become established. If, however, they are mown in the manner suggested, they cease to create the shade which is harmful to the valuable pasture plants.

The preparation of ground for the sowing-down of grass in autumn is a matter of seasonable moment. In general the most economical means of providing the mellow, firm seed-bed that assists in begetting the fullest success in pasture establishment consists, in part at least, in commencing the preparation of the seed-bed far enough ahead to allow time for natural weathering agencies to play a considerable part in the breaking-up and firming of the soil. Clovers which are essential in fully successful permanent pastures call particularly for consolidation, the widespread value of which is illustrated by the fact that the best portions of pastures, in respect both to grasses and clovers, are often to be found round the headlands, which have necessarily been subjected to greater consolidation by the passage of horses and implements.

The purchase of pasture seed mixtures is of such importance that it receives the personal attention of efficient farmers. Instead of being left to the last moment before the seed is to be sown, the purchase of seeds should be undertaken early enough to ensure that there will be time to obtain seed of desirable strain, purity, and germination capacity. As the strain of seeds is a character of fundamental importance which has come into the foreground during recent years, it is fortunate that the official system of certification of seeds has made the quest for desirable strains of the more important pasture species a relatively simple task in practice. The basic fact is that an ever growing mass of field experience shows that, as a rule, it is false economy not to use certified seeds when supplies are available. During the current seed harvest certified seed of rye-grass and cocksfoot will be described either as " mother " grade or as " permanent pasture " grade, while in respect to both white and red clover there will be an additional grade termed " first harvest, permanent pasture." The

" mother " seed should be used by all who contemplate the future production of certified seed, as it not only gives greater assurance of purity of strain, but also enables certified seed to be harvested at the minimum interval after sowing. Care should be taken to preserve the printed statements inserted in sacks of machine-dressed mother seed. These printed statements are known officially as " insert slips," and constitute essential evidence at a later stage, when application for seed certification is being made, that the required mother seed was used originally. The other grades of certified seed are quite suitable for all pasture purposes apart from certified-seed production. The purity of certified seed, especially in the case of mother seed, should be taken into consideration, for the purity of lines of certified seed varies considerably. It is also a sound precaution to ascertain the germination capacity of certified seed—though occasional lines are of quite low germination, they are not generally quoted at a price which is correspondingly low.

Some of the grassland on many farms may, with distinct advantage, be top-dressed with phosphates in February or a little later—generally such top-dressing increases the autumn and winter supplies of fresh leafy feed, and, even should dry conditions occur for a considerable period after the distribution of the phosphates, their influence will not be lost but merely postponed until the required soil moisture is provided.

Considerations relative to Seed Mixtures.

In recent years authoritative views in respect to seed mixtures for permanent pastures have been substantially modified. One of the major changes is the limitation in the number of species recommended in specific mixtures. This change is a result of more thorough knowledge. The object of the earlier practice of using a wider range of species was to increase the likelihood of including those actually needed. But with greater knowledge not only of the species really needed, but also of those not needed, under a particular set of circumstances, it is possible with safety to narrow the range of species sown, and thereby, without sacrificing efficiency, to bring about a welcome saving. Another important change is the greatly increased weight given to strain differences within a species. In this respect the informed view in respect to pasture plants is now paralleling that which has for long obtained in respect to many arable crops. Ordinarily only a slip-shod farmer would have been content to sow wheat or turnips or maize as such without seeking some knowledge of the sort of wheat and so on. But even the careful farmer, usually, of necessity, sowed perennial rye-grass, cocksfoot, white clover, &c., without giving any consideration to the possibility of different sorts of perennial rye-grass, &c., being of different values. With recent intensification of attention upon strain differences within pasture species this is now ended. A further important change is represented by the view that cocksfoot should be so widely used in greater quantities than were customarily included in seed mixtures in the past that cocksfoot is now a major constituent in the great majority of the sowings of permanent pastures. These three changes suffice to suggest that in determining upon pasture seed mixtures it is advisable to keep abreast of current knowledge which at times is ignored in the advice that is tendered to prospective purchasers of seed mixtures, about which detailed information is available from district officers of the Fields Division.

The Breeding Ewes.

In the North Island farmers undertaking fat-lamb production usually put out the rams at the end of February or early in March. If the ewes tend to be overfat they should be put on a scant diet early enough to bring about a sufficient reduction in condition. Flushing the ewes for about ten days before the rams go out is of known value, for investigations have

shown that the highest birth-rate is secured when ewes are in moderately good condition which is improving at the time of mating. Flushing can be carried out by providing some succulent feed such as rape after the first feeding-off of the lambs, or by putting the ewes on the best available short pastures and thereby providing them with more nutritious food—*i.e.*, better keep, at the appropriate period. The better keep by its stimulating effect tends to beget a greater proportion of twins produced in the earlier part of the breeding season. The farmer need not forego the benefit of flushing in respect to ewes that are becoming too fat. His course then is to confine such ewes to poorer rations up to within about a fortnight of putting them to the ram—the flushing being done as described above.

February a Difficult Period in Dairying.

One measure of efficiency in feeding a dairy herd is the rapidity of the decline in production of butterfat in late January and February. Even in some of the most favoured dairying districts the daily production of butterfat in February is only about 75 per cent. of what it is in December. Such a rapid decline in production is not natural, even for cows which are not of particularly good dairy type, and there is ample evidence that in general the rate of fall at this stage could be greatly minimized by feeding in closer accordance with the needs of the producing cow. Improvement could be expected if it were more thoroughly realized that diets which consist essentially of pasture that is long and stemmy, or of overmature special forage crops such as maize, millet, and lucerne in the flowering stage, or of silage made from grass cut when it was approaching the stage typically adopted for hay, are fundamentally unsuitable for cows of reasonable production. Such diets favour body-fat production rather than butterfat-production, and their use explains why at this season cows which are at all inclined to beef commence putting fat on their bodies instead of into the bucket. There seems to be no easy course that will lead to the satisfactory avoidance at about February of diets which are unfitted for efficient butterfat production. The maintenance as far as possible of pastures in a short leafy condition is of assistance, but such pastures alone seldom are adequate and usually require supplementing by such measures as the feeding of young succulent lucerne or red clover before it has developed much woodiness that accompanies flower-production, the feeding of young millet or the feeding of soft turnips. The fact that an avoidable decline in production at this stage is reflected unfavourably in the production for the whole of the remainder of the season seems at times to be overlooked. Otherwise, it would be difficult to explain why the use of suitable crops which are available is postponed, either because they may be more acutely needed later on or because they would eventually give greater yields. The point of practical moment is that later they may not be so acutely needed. Definitely in these circumstances a present pound of butterfat is preferable to a problematical future pound, and in February, as a rule, it is sound practice to make the fullest possible use of the succulent feed available.

Seasonal Work with Lucerne.

At times in February it is advisable to mow young lucerne which was sown in November or December. Generally such a mowing is necessitated by a vigorous development of weeds which tend to "choke" the lucerne seedlings by lessening their supply of moisture and of direct light. But if weeds do not threaten damage to the lucerne seedlings in this manner, then such an early first mowing should not take place. During the young stages of the crop, leafage, if unchecked, assists considerably in building up an extensive root system which is capable of serving well in subsequent difficult periods. One of the critical periods in the life of lucerne seems to occur at the first spring following the sowing of the crop, and an extensive

root system built up during the first summer is extremely useful at this critical spring period in assisting the crop to compete against invading weeds. In some districts, especially those in which grasses and clovers are not among its serious competitors, lucerne has been sown with success in February. Good germination is favoured by the warmth which the soil then possesses. Further, the crop sown in February is likely to escape much of the competition from certain weeds such as fathen, which at times greatly interferes with the establishment of a spring-sown crop. Where the grass grub is prevalent it is desirable that the land to be sown with lucerne in February should have been free from grass or cereals during the earlier part of the summer when eggs of the grub were being deposited.

As a rule, a suitable time for the cultivation of lucerne is after the second cut of the season; the essential objective of cultivation is normally the suppression of weeds, and the dry conditions which commonly obtain at about the time of the second cut assist considerably in weed control. If weeds are not making inroads in lucerne, cultivation at any time is likely to be not merely unnecessary, but actually undesirable.

Good results may be expected from top-dressing lucerne with phosphates in summer. Generally summer top-dressing benefits lucerne almost exclusively, whereas the benefit of spring top-dressing may be shared between lucerne and other plants which in lucerne are weeds irrespective of their worth under different conditions.

Late Sown Turnips and Catch Crops.

If further forage-crop production is desirable, valuable work in respect to additional cropping may be carried out during the coming few weeks. In many localities there is still time to sow such turnips as Hardy or Imperial Green Globe and White Stubble. Swedes are less satisfactory for late sowing. Often vacant land offers valuable opportunities for the growing of catch crops. For instance, land in oat stubble, if cultivated as soon as the crop is removed and then sown in Western Wolths rye-grass and red clover will provide autumn and spring feed, which is often of marked value and especially to farmers operating under Canterbury or similar conditions. Black Skinless barley sown at the rate of 2½ bushels an acre develops so quickly that it provides good feed for dairy cows or sheep in about eight weeks. Often it can suitably be sown immediately after oats in February and is then likely to provide feed at a period when it is welcome. Garton oats similarly used are also widely suitable as a green feed catch crop, provided it is not planned to obtain a further growth after the first feeding-off of the crop. Algerian oats rightly are popular for later sowing and later feeding. With all of these crops it is usually distinctly profitable to apply superphosphate at the rate of 1 to 2 cwt. an acre.

General Cropping-work.

All crops sown in rows wide enough apart to allow of intertillage call for summer cultivation at regular intervals until the development of leafage makes cultivation impracticable. No general rule as to the frequency of carrying out this cultivation can be enunciated; on soils which contain a considerable amount of fine silt or clay and which, hence, readily become caked on the surface, a short, heavy, beating rain may so consolidate a loose surface as to make it in need of tillage even though it had been cultivated shortly prior to the rain. The ideal result is the maintenance of a continuously loose surface layer of soil which checks the loss of moisture from the soil and so is of particular value under dry conditions. Hence summer surface-tillage is of distinct value irrespective of its obvious use as a means of controlling weeds.

While summer cultivation continues to be a useful practical means of dealing with weeds such as fathen, docks, willow-weed, &c., occurring in

such crops as carrots, mangels, and potatoes, it seems worth mentioning that summer cultivation alone is not satisfactory as a means of ridding land of persistent perennial weeds such as sorrel, yarrow, creeping fog, and other "twitchy" weeds. Although summer cultivation can be employed usefully to weaken greatly weeds of this type, it is not a satisfactory means of completing their destruction, and it should as a rule be associated with subsequent practices such as the growing of dense shading crops which are suited to carry on the weakening process initiated by the summer cultivation. Included among the crops suitable for this purpose are: (1) Italian rye-grass and red clover sown in the autumn and eventually saved for hay; (2) Algerian oats, autumn sown, and eventually cut for chaff or hay. If after such dense crops the weeds still promise to cause trouble, they may often be dealt with satisfactorily by growing one of the following crops, which should be well tended and well nourished so as to exert the maximum weakening influence on the weeds: Mangels, potatoes, rape, chou moellier, oats and peas, or oats and tares. The position summarized is that a suitable rotation of crops which is spread over a number of seasons and which pays its way throughout is preferable, as regards both effect achieved and outlay necessary, to an intensive effort devoted to summer fallowing which, at times, was looked upon as a standard measure against persistent weeds.

A further fact of seasonable moment in dealing with weeds is that often direct attack upon such weeds as sorrel, brown-top, creeping-fog grass, and similar "twitchy" weeds is inadvisable. The best mode of dealing with them often is to sow the land in pasture and by appropriate top-dressing and management to make the conditions so favourable to the growth of the grass that the resultant vigorous sward gradually weakens the weeds and so lessens their activity that even though they may not be eliminated the damage they do becomes negligible.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Seasonable Spraying.

MANY growers throughout the Dominion make a very grave mistake by discontinuing spray applications many weeks too soon. Presumably this is done for economic reasons, the theory being that the cost of spraying towards the latter part of summer and early autumn is not warranted.

This theory, however, is a penny-wise and pound-foolish one. The discontinuing of spray applications too early in the season will inevitably result in a far greater percentage of rejected fruit during the process of grading. The result of a few insect stings, injury of leaf-roller caterpillar or pin-head black-spot individually or collectively, is all that is required to reduce otherwise extra-fancy fruit to the reject class In view of these circumstances, it is recommended that spraying operations as outlined in the November notes be carried on as late as possible. At the same time, however, prospective shippers should take into consideration the necessity of reducing spray residue on fruit intended for export to a minimum. This may be accomplished to a certain extent by leaving a margin of time of, say, ten to fourteen days between the last spray application and first picking of each variety. Varieties intended for cool or ordinary store should be kept well covered with the spray referred to above until just prior to picking.

Cover Crops.

To obtain the maximum benefit a cover crop should be ploughed under as soon as it reaches the flowering stage, while the correct time to

plough such a crop under is about the last week in May or early June. Therefore, those growers who intend sowing such a crop are recommended to take the foregoing remarks into consideration and sow accordingly. Cover crops are to be recommended and should take a definite place in the routine of orchard practice, for they not only improve the physical condition of the soil and subsoil, but add organic matter to it. Leguminous cover crops such as lupins (blue or white), peas, or vetches are recommended, as they supply nitrogen as well as organic matter to the soil. A seeding of from 40 lb. to 50 lb. lupins per acre is recommended, and seedings of vetches 1 bushel, oats 1½ bushels, and field peas 60 lb. per acre should be sufficient for this purpose. A dressing of superphosphate from 2 cwt. to 3 cwt. per acre will greatly benefit the cover crop by ensuring an abundance of top growth for turning under.

Fruit Export.

During the coming month, February, fruit-export activities will commence, therefore growers are well advised to anticipate the arrival of this busy period by having all necessary material to hand such as cases, nails, strapping wire, labels, straw-boards, and the various stamps necessary for branding cases. Advantage should be taken of every spare hour and wet day in nailing the cases together and attaching the labels. It is a good plan to soak the labels in water and attach them to the case while wet; this is a simple operation. Place the labels one by one in a pan of clean water, apply the paste to the end of the case (not to the label) with a brush, take a label from the pan of water and place it in position and wipe off with a squeegee or clean cloth and allow to dry before stacking away. The grader should be overhauled, cleaned, and well oiled before it is required for use, and similarly the engine or other power employed for driving the grader. If this work is completed before the packing-season commences it will save considerable time, and possibly much confusion later on.

In making the first packing of fruit for the season care must be taken not to remove from the trees immature, undersized fruit or fruit not carrying the necessary colour requirements. This can be avoided only by very careful picking, carried out by experienced pickers. These pickers should be familiar with the essentials that must be observed when picking fruit for export—*i.e.*, colour requirements, maturity, size, freedom from disease, and blemish. The right degree of maturity for picking for export is a most important and to some extent a difficult point to decide, chiefly owing to the thousands of miles that must be covered before the fruit reaches its destination. The most reliable guide when deciding if the fruit is sufficiently mature for picking is the distinct change from green to light yellow of the ground colour, plus the ease with which the fruit parts from the tree. Pickers should be instructed to keep their finger-nails closely trimmed, and to use the palm of the hand as much as possible, not the thumb and fingers, when gathering fruit. By taking hold of the fruit in this manner and giving it a sharp turn upwards, the fruit if sufficiently mature for picking should break clean away from the spur with the stem intact. Considerable loss results if the fruit is carelessly and roughly removed from the tree: not only is the stem pulled from the fruit in this manner, but fruit spurs provided by nature for future crops are broken off.

Growers in their own interests should make every endeavour to eliminate as nearly as possible the heavy percentage of bruised or otherwise injured fruit that is usually to be found in almost every packing-shed. This injury is caused by rough, careless, and thoughtless workers, either in the orchard or shed or both, and can no doubt be reduced to a minimum if reasonable care is taken during the process of harvesting and packing fruit. The

overfilling of picking-bags and orchard boxes should be avoided, also the dropping of cases of fruit. In fact, rough or careless handling of fruit of any description should not be tolerated in the packing-shed or orchard.

—*J. W. Whelan, Orchard Instructor, Palmerston North.*

Citrus Culture.

As a result of the prolonged spell of dry weather the young growth on citrus trees will be retarded and a loss of young fruit and foliage may also occur in situations where the moisture content of the soil is much below normal. The maintenance of a soil mulch by surface cultivation is essential to conserve moisture. The destruction of weeds is also very necessary, as much moisture escapes from the soil through these. Should the dry weather continue some additional mulch will be required to conserve the moisture. Stable manure is preferred, but if this is not available, hay, straw, or any litter will serve the purpose. Care should be taken not to allow the material to come in contact with the trunk of the tree, as bark injury may be caused by such contact.

Young shoots should be pinched back to a suitable point so as to encourage side lateral growth. If left to mature, these shoots often grow 3 ft. or more before developing side laterals which in such circumstances usually grow only on the extremity, leaving an undue length of wood unfurnished. By pinching out the growing point of these shoots as suggested laterals are forced nearer the base and growth encouraged where it is most useful. Should the weather become humid, spray with Bordeaux 3–4–40 to check verrucosis.

Where red scale is present spray with a summer oil 1–40 when the young scales are on the move. From two to three applications at an interval of three weeks are recommended.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Management of the Developing Pullets.

NEXT month should see many of the pullets exhibiting such signs of beginning to lay as making a cackling noise, showing a red developed comb, a fullness of the abdominal region, and generally an adult appearance. No time should be lost therefore in getting the young birds into their permanent winter quarters. It is very essential that they be well settled down before their productive season commences, as any change of quarters at the time they are commencing to lay is a common cause of their going into a moult with the adult birds, and this at a time when eggs rapidly advance in price. The same result may be brought about by changing the food, or by subjecting the birds to fright by rough handling, &c. It will thus be seen that the more uniform the treatment pullets receive just before and after they have attained a laying stage the less risk there will be of their going into a premature moult.

Of course the very early hatched pullets will probably be laying before this, especially where the common mistake has been made of providing them with a highly forcing diet, and in most cases they will moult in the late autumn even when given the best care and attention. As a rule, however, the moult is a light one, and if the birds are well fed and managed they will soon recover and become productive again. When the pullets are commencing to lay they should be watched for a time, and discouraged from laying their eggs in odd corners of the house instead of in the nests.

Generally speaking, if one bird is allowed to lay its eggs on the floor of the house, others are apt to do the same. This means that the eggs are apt to be covered up in the litter, and are not gathered in a fresh condition. The placing of an obstruction where the bird has acquired the habit of laying, and having the nests slightly darkened will tend to break the habit. Nest-eggs should also be provided, but these will not tend to make hens lay when they do not want to, as is often supposed by the inexperienced person. A nest-egg, however, often induces a pullet when commencing to lay to produce her egg in the nest instead of in odd corners in the house.

Feeding the Chickens.

A common and mistaken idea held by many people in these days is that chickens cannot be successfully reared on a simple ration consisting of sound grain materials, green food, animal food, and clean water. It is frequently claimed that for chickens to do their best, the use of certain chemicals, tonics, and stimulants is imperative, and that chickens fed with these will make greater progress than where a plain simple ration is fed. This may be the case where the chickens concerned are constitutionally weak and pampering is necessary to rear them. The most successful men to-day will admit that the chick reared by the hen, under natural conditions, has the best start in life, as it matures naturally and has therefore a greater opportunity of developing a sound and vigorous constitution. The chick artificially stimulated with tonics, chemicals, &c., may for a time show quicker development so far as size is concerned, and may even, as is often claimed, come to lay at a much earlier age but this is because it is a more forced product. There is here a distinct analogy between the plant reared under natural conditions in the open and provided with natural food, making for hardiness and resistance to disease, and the hot-house plant which has only the advantage of size and early maturity due to the artificial forcing to which it has been subjected. The most important advance made in recent years in artificial brooding has been the elimination of forcing conditions as much as possible, removing the risk of the chicks securing too much warmth and giving them only a sufficient degree of heat to enable them to thrive, and while guarding against extremes of temperature, introducing the hardening-off process by degrees, with as little delay as possible. Even allowing that, as a result of feeding stimulants, &c , the birds do come to lay earlier, the ultimate advantage of this is doubtful. One weakness in egg-production to be guarded against is the small size of many eggs at the present time, as indicated by the fact that eggs that weigh about 1¾ oz have to be exported in order that sufficient of the summer surplus may be shipped overseas, for the maintenance of paying values on the local market. It is certainly not to the unduly forced bird that we must look for improvement in this respect. It is not the early maturing diminutive bird that should be aimed for, but the bird with good bodily development that has the power to last out one or more long heavy-laying season, as well as the power to resist disease ; and these birds as a rule lay a decent-sized egg. It is not when a bird commences to lay, but the number of eggs she will lay in two or more seasons under ordinary conditions, and while her product is of good marketable size commanding the highest prices on the overseas market, that is the factor which determines her value. The old hen which has passed the experimental stage in rearing chickens when on a free range, gives a striking lesson worth following in regard to feeding the artificially produced chick. If the crop of a chicken being reared under natural conditions is opened up a good variety of food such as soft seeds, tender shoots of grass, insects, and worms will be found. This also provides the lesson that it is unnatural for a baby chick to eat hard grains such as broken maize, wheat, &c. With such foods, where the artificially produced chick is concerned, it is always wise to moisten the grains with hot water or milk in a covered receptacle

and allow them to swell before being fed to chicks during the early stages. If there is any doubt on this point, a batch of chicks should be divided, giving one-half hard dry food and the other half food that has been moistened before feeding and watch results. The aim of the poultry-producer should be to rear his birds in such a way that they will possess desirable size, constitutional vigour, and be producers of standard grade eggs—*i.e.*, eggs over 2 oz. in weight—during their productive period. To achieve this end the birds should not be encouraged to lay before they are six months old.

I would again emphasize that the chief essentials in successful chick-rearing under artificial methods are to have the chicks hatched at the right time from healthy breeding stock, uniform temperature under the hover, a proper system of ventilation without draught, feeding only sound grains, succulent green material, sea-shell, gravel grit, charcoal, a fair proportion of animal food, clean water to drink or milk preferably fresh, strict attention to cleanliness, and clean ground to run on. Given these conditions, the young birds will require no medicines, tonics, &c., at any rate so far as New Zealand conditions are concerned.

Lameness in Young Ducklings.

Several complaints have reached me of late regarding lameness and loss of leg-power in ducklings that were being reared by artificial means. This may be due to having the drinking-vessels insufficiently deep to allow the birds to get their heads well under the water to keep their nostrils from becoming clogged up with food, &c. Another cause and the most common one, is dampness in the sleeping-quarters and allowing ducklings to sleep on wet bedding-material. Curing leg trouble is out of the question, and the only safe course is to prevent it. The first step in this direction is to provide drinking-vessels which will allow the young birds to get their heads well under the water. Further care must be taken to keep the bedding-material in a dry state, and with this in view, the drinking-vessels should be placed well away from the sleeping compartment. This will go a long way towards preventing the droppings from the birds after drinking coming in contact with the bedding. In furtherance of this end, a good plan is to have a low wooden frame covered with small-mesh wire netting on which to stand the water-fountain, while a flat dish is placed underneath. Then the droppings, when the ducks are drinking, will fall into the dish. This will help greatly to keep the quarters in a dry state and the birds healthy.

It goes without saying that if brooder ducklings are to make sound development and be free from lameness and other troubles, it is necessary that they be well supplied with fresh crushed oyster or other sea-shell from the day they are placed in the brooder right throughout their growing stage.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Taking Surplus Honey.

WHERE the beekeeper has succeeded in getting his colonies into good order for the honey-flow, there should be some honey for extracting by the end of the month. If the stocks of surplus combs on hand are not sufficient to harvest the crop, there is a danger that the immediate requirements of the bees may not be met. It is well, therefore, to look over the upper stories and note which contain sealed honey. These can then be removed and extracted, and returned to the hives to be refilled.

In this early extracting great care must be exercised not to remove any combs but those which are fully sealed, as in the height of a honey-flow much unripe honey will be present in the hives, and this, if extracted, is likely to ferment. The practice of extracting from unsealed combs during a flow cannot be too strongly condemned, as it results in the production of honeys of poor flavour, coarse grain, and low specific gravity. All partly sealed combs should be left on the hives until after the flow, in order to get the honey in them well ripened.

Extracting during a flow has advantages, providing the above precautions are taken, as fewer combs are required and little or no robbing has to be contended with during the tedious process of removing honey from the hives. Where ample stocks of combs are on hand to meet the demands of a large flow the hives can be supered as required, and then the work of dealing with the crop may be left until the end of the season. If this practice is followed the beekeeper will be assured of a well-ripened honey of good quality and high grade.

Use of Bee-escapes.

For removing honey from the hives there is no better device than the bee-escape. The usual practice followed when the time for extracting is at hand is to remove the frames one by one. If excluders are used much time will be saved in picking over the combs. As the combs are taken from the hives shake the bees in front of the hive, brush off the remaining ones, and place the combs in a hive body for removal to the honey-house. Some beekeepers practise removing full supers, which are bumped on the ground to cause the bees to fall from the combs. This is not a good plan, as during the operation many bees are killed, combs are broken, and robbers are soon in evidence. Others practise smoking between the combs excessively, in order to get the bees out of the supers. There is danger in this method of demoralizing the colony, resulting in it being an easy prey to the robber bees, and causing the attendant risk of injuring the quality of the honey by tainting it with smoke.

There is no more satisfactory way of getting the bees out of the supers than by the use of escapes, and when their advantages are weighed it is a matter of surprise that they have not been more largely adopted. There is no stinging, smoking, brushing, or robbing when the honey is removed. Escapes are now made for the greater part of wire cloth. The advantage of this is that it allows the warmth from the bees to pass into the super during the night, thus keeping the honey warm; the bees can also clean up the drips of honey that fall from the burr combs. In inserting the escapes gently prize up the super from the brood-chamber and insert the device. A puff of smoke will suffice to control the bees while the operation is being performed. If this is done late in the afternoon the bees will have gone down to the brood-chamber before the following morning, and the honey may then be taken off without disturbing them. A word of caution to those who have not formerly used the escapes: Should there be brood in the super combs the bees will not leave, and the escapes will not prove effective in ridding the supers.

Honey-tanks.

For the preparation and care of the honey after extracting it is necessary to provide suitable tanks. These should be made of tinned steel and externally soldered, in conformity with the regulations under the Sale of Food and Drugs Act. It has been proved by experience of late years that deep narrow tanks are the most suitable. These tanks obviate to a great extent the disagreeable necessity of straining the honey, and help to eliminate both froth and scum, which render the honey unsightly when it rises to the surface.

Extracting.

To carry out extracting expeditiously two people should be engaged—one to do the uncapping and the other to operate the extractor. In the process of uncapping the comb is placed on the cross-bar on top of the uncapping can. The projecting screw point prevents the frame from slipping and acts as a pivot on which to revolve the combs. The comb should be placed with one end resting on the pivot and tilted slightly forward, in order to allow the cappings to fall away from the combs as they begin to peel off. For removing the cappings what is known as the Bingham knife is usually first favourite. Provision must be made to keep the knife warm, and this can be accomplished by immersing it in hot water. The knife should have a keen edge, and be thoroughly clean before starting operations. Uncapping should commence at the bottom and the knife proceed with a forward and backward motion, the same as when using a saw. Make a practice of uncapping as wide a surface as possible, and endeavour to remove the entire surface of the comb without once removing the knife. A little experience will enable the operator to cut below the surface of the cappings, and it should be remembered that the cleaner the cut the freer the honey will be of wax particles when extracted.

After the combs are uncapped the problem of dealing with the cappings must receive consideration. Where these are stored for a indefinite period the honey may granulate or take up moisture from the atmosphere and thus become a total loss. If the beekeeper does not possess one of the melters in general use he should improvise some means for straining the cappings. A hive-body covered with coarse wire cloth at the bottom and placed in a tray with a lip provided at one end to drain off the honey will answer the purpose for small quantities of cappings. For dealing with large quantities it is well to install a good melter, but before doing so the beekeeper should satisfy himself that it will not impair the quality and colour of the honey.

Returning the Combs.

After the combs are extracted they should be placed on the hives in the evening. If this practice is followed the bees have a chance to clean them up during the night, and robbing is not likely to follow. Nothing will excite the bees more than wet combs placed on the hives during the day; they promote wholesale robbing, and, moreover, the bees take advantage of the opportunity to enter the honey-house every time the door is opened.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

WINTER crops planted out during the past month will require careful attention to keep them clean of disease, pests, and weeds and get them growing strongly. To do this, hoeing occasionally to destroy weeds before they pass the seedling stage and conserve moisture; also a light dressing of nitrate of soda or sulphate of ammonia as may be necessary, will be of great assistance. Seedling crops so soon as they appear above ground will also require similar attention. Such operations, carefully carried out, following the sowing of seeds of good strain, in land that has been well-prepared, are the main factors in successful cropping.

Cabbage and cauliflower for spring cutting should now be sown in seed-beds. These must not be forced, but grown steadily to produce sturdy plants. Select a piece of land that is warm and well-drained and have it ready for setting out with these plants during the month of April.

Tomato Crops.

It is a common experience to grow excellent crops of tomatoes under glass, with little difficulty, for the first two or three years after the house has been built. Then troubles of many kinds arise in the course of future cropping and the fine assurance one had acquired begins to disappear. The initial success is largely due, no doubt, to the fresh soil and clean house facilitating the work. An important problem is how best to maintain these facilities.

It may be done by thoroughly cleaning the house promptly as soon as the present crop is finished. This is best commenced by fumigating the house with burning sulphur to destroy all fungous spores that would otherwise infect the following crop. Screened agricultural sulphur is burned at the rate of 10 lb. per 10,000 cubic feet. It should be distributed in a number of small heaps on the surface of the ground and ignited after pouring a small quantity of methylated spirits on the centre of each heap. It is best carried out during a quiet evening with no wind. Close the house up tight, ignite the sulphur, retire, and lock the door, placing, if necessary, a wet sack to stop any opening there may be under the door. The following day open all doors and ventilators; cut the plants through a few inches above the surface of the ground and carry out all tops and strings and burn them as soon as they are dry. Then sweep the house clean of all dust and rubbish, and carefully dig all roots and burn them. The cleansing of the house is then completed by washing the interior down, or spraying it well, with cresylic acid emulsion. This is made by placing one gallon of pure cresylic acid and 8 lb. potash soft soap in a bucket and heating it over a fire until all the soap is dissolved. This concentrate is used at a rate of one part to 50 parts of water. It should be carefully applied with good pressure to every part of the roof, walls, and surface soil. The ventilators should be left open while this is done, but should be closed down tight for four days when spraying is finished in order to retain the strong vapours. The house may then be opened up and planting commenced, if desired, fourteen days after treatment.

From experience during the growing season, the examination of the roots when digging them, one will obtain a good idea of the conditions of the soil so far as pests and diseases are concerned. If these are present they may be destroyed by sterilizing the ground with steam, or for fungous diseases saturating the soil with a solution of formalin; or, in the case of insect troubles, by fumigation with carbon bisulphide or saturating the soil with a solution of Restar, using it at a rate of 1 pint to 10 gallons of water. In the latter instance the Restar solution may be used in the place of cresylic acid emulsion for washing down as well as soil pest control.

As work of this kind may be done most effectually in a well-built house in good repair, any repairs needed should receive attention, all cavities and crevices being properly puttied and woodwork painted periodically.

After the above-mentioned interval market crops may be planted or a green cover crop for turning under

Small Fruits.

In warm localities in the North, strawberry planting is done during the month of April, but in colder and southern districts the latter end of February, or as soon as plants are available, they should be set out.

This should only be done in land that is thoroughly clean, well supplied with humus, smoothly graded, and well settled to a firm bed. At the last ploughing, or digging, turn under a good dressing (2 oz. or 3 oz. to the square yard) of blood and bone manure, and harrow or cultivate in a dressing of superphosphate and sulphate of potash when working down weeds.

Two or three weeks later planting may be done. Where beds are down only for one year the plants are set rather close, 24 in. by 9 in., but for vigorous varieties or where beds remain down for a few years 30 in. by 12 in. is generally more suitable. The plants should be set firmly when the land is dry enough to be free from any stickiness.

Established beds should be cleaned up, all runners removed, and a dressing of fowl-manure in a friable state cultivated in.

The Homestead Garden.

Where spring-flowering bulbs have been lifted for replanting, the work should now be completed as soon as possible. As with most plants of small to medium size, they look best when planted in rather large groups of one variety. Occasionally, where the conditions are suitable, a very large group looks well, as in the case of wood hyacinths, grape hyacinths, or daffodils planted in grass.

Lilies have a very short resting period, and where planting is contemplated it should be done as soon as the flower stem ripens, taking great care to allow the bulbs to dry as little as possible in the process. *Lilium candidum*, known here as the Christmas lily, is now mature and is one of those ready at the present time for replanting. These handsome plants usually require little attention once they are established in a suitable position, and many are not the least fastidious *L. auratum*, *L. speciosum*, and *L. longiflorum* are stem-rooting kinds which should be planted rather more deeply than *L. candidum*, which forms no roots on the stem above the bulb.

Groups of bearded iris with their rich colours make a good display during spring or early summer They also should be planted now; they are great lime lovers, and should be planted with the upper half of the rhizome showing above the ground.

Roses generally receive the consideration of planters Whether they are planted on the smallest or largest scale, no plants probably afford so much pleasure for the cost incurred. They are best selected now while the mature plants are in blossom so that the colours and habit may be definitely ascertained, as it is not possible to plant effectively without that knowledge. Also for a permanent crop such as this, the land should be trenched and thoroughly prepared, so that a commencement with this work may be made at any time now in readiness for planting during the month of May.

As a guide to selection the following result of a plebiscite taken recently in Melbourne is of assistance. The voting gave the twelve best roses as Lorraine Lee, pink and orange; Etoile de Hollande, dark red, Shot Silk, cerise and orange; Chateau de Clos Vougeot, scarlet, Golden Emblem, pure yellow; Ophelia, salmon flesh; Sunny South, pink flushed carmine; Dame Edith Helen, fragrant pink; Madam Abel Chatenay, carmine rose shaded salmon; Mrs. Herbert Stevens, white, Mrs. Bryce Allen, carmine rose, fragrant; Madame Butterfly, pink shaded yellow, fragrant. These are all excellent varieties, but might very well include more yellows such as Rev. F. Page Roberts, Lady Hillingdon, and Angele Pernet.

The list of best climbing roses included Black Boy, crimson scarlet, Miss Marion Manifold, crimson; Paul's Scarlet; Climbing Lady Hillingdon, and Climbing Ophelia.

Roses are often planted widely spaced in the mixed border; this method is not effective in appearance, neither does it provide the right conditions for good growth unless the plants are of exceptional vigour such as Hugh Dickson or Frau Karl Druschski. A better practice has been to plant in well-prepared beds, but one variety in each, this is rather a limiting factor unless the rose-garden is very large. In many instances it would be best to plant groups, each of one variety, in harmonizing colours in each bed, taking care to plant the dwarfer kinds in front of the more vigorous varieties planted in the centre, setting them respectively about 2 ft. and 4 ft. apart. Beds about 6 ft. wide are most suitable; it is not generally advisable to make them wider.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: DECEMBER, 1933.

Dominion Meteorological Office.

NOTES FOR DECEMBER.

THE first half of December was very dry and warm, many parts of the country having no rain at all. In Marlborough, especially, and to only a slightly less extent in Nelson, the situation prior to the 17th was very serious, and although some good rains fell thereafter, they were too late to save large areas of crops. Pastures are generally in the dry condition usual about a month later in the summer.

Rainfall.—There were some heavy falls in eastern districts of the North Island on the 1st, but otherwise it was extremely dry until the 16th. From then onwards stormy and wet weather prevailed, and the situation was considerably improved. Over most of the North Island, however, the total rain for the month was much below average. There were some exceptions in South Taranaki, Hawke's Bay, and East Cape districts. In the South Island there was still a deficit at the end of the month in northern Nelson and Marlborough and in southern coastal districts. In Canterbury, Westland, and much of the interior of Otago, on the other hand, the normal was exceeded, and the soil is in a satisfactory condition.

Temperatures.—Owing to the high temperatures of the first half of the month, the cold weather of the last seven or eight days was not sufficient to lower the average below the normal for December. Though the mean temperature was everywhere above normal, it was in the interior and in Westland that the warmth was especially marked. Some frosts occurred during the last week, especially in the interior of the South Island.

Sunshine.—Except at scattered places in eastern districts, sunshine was generally considerably above the average. Nelson had 320·3 hours, Blenheim 304·7, and Lake Tekapo 296·0 hours.

Storm Systems.—The month opened with high pressure over New Zealand, but a series of small cyclones passing to the east of the Dominion on a south-easterly course was responsible for the prevalence of southerly winds and cool temperatures during the first day or two. Between the 5th and the 7th a shallow westerly depression passed, but produced very little rain. Following another spell of high pressure, there was a second shallow depression on the 10th, but again scarcely any rain resulted.

The third depression, however, which dominated the weather between the 15th and 18th, was much more vigorous. It produced practically general rains with many heavy falls, and marked the end of the drought.

The next storm was experienced between the 21st and 24th. It became very deep after crossing New Zealand, and was followed by strong southerlies which were responsible for a cold Christmas, conditions in the South Island being almost wintry ; rain was widespread and hailstorms did some damage, especially in the South Island. Heavy snowfalls occurred on the mountains. Banks Peninsula received a white coating, and even in Christchurch there were some snow showers.

The fifth and last storm raged from the 27th to the 30th. It, again, became very deep after passing to the eastward, and the southerlies which resulted far surpassed those of its predecessor in severity. The gale commenced in the south on the 28th and did not die out over the North Island until the night of the 30th. In many places it rose to a whole gale, being one of the worst southerlies experienced for many years. Once more there were heavy snowfalls down to low levels on the mountains and numerous hailstorms. Heavy rain fell at many places. Much damage was done to fruit and crops and vegetation generally by the cold, the hailstones, and the persistent gales.

RAINFALL FOR DECEMBER AND CALENDAR YEAR, 1933, AT REPRESENTATIVE STATIONS.

—	December, 1933.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall.	Average Rainfall.
North Island.						
	Inches.		Inches.	Inches	Inches.	Inches.
Kaitaia	1·25	7	0·55	2·61	44·31	54·31
Russell	1·31	6	1·00	2·60	71·47	49·94
Whangarei	1·51	6	0·47	2·98	57·94	60·51
Auckland	2·15	6	0·98	2·91	42·49	44·87
Hamilton	2·31	8	0·73	3·55	44·91	49·54
Rotorua	1·30	8	0·66	3·76	50·83	54·98
Kawhia	3·97	8	1·10	3·34	53·53	53·72
New Plymouth ..	4·12	11	1·61	4·28	51·64	59·80
Riversdale, Inglewood	5·98	12	2·28	7·57	87·10	104·17
Whangamomona ..	3·24	8	0·61	5·72	67·90	77·55
Hawera	3·46	9	0·87	3·37	43·06	45·21
Tairua	1·48	7	0·75	4·34	69·78	64·44
Tauranga	1·74	7	1·04	3·62	49·85	52·37
Maraehako Station, Opotiki	2·96	7	1·36	2·91	63·31	53·37
Gisborne	2·01	7	1·30	2·31	43·33	45·13
Taupo	1·77	9	0·78	3·17	32·52	43·87
Napier	3·43	7	1·82	2·31	29·34	35·02
Hastings	1·80	7	0·74	1·93	27·36	31·86
Whakarara Station ..	1·96	7	0·85	..	..	..
Taihape .. .	2·95	9	0·70	3·30	35·63	36·93
Masterton	1·11	10	0·26	2·89	31·07	38·54
Patea	3·96	10	0·84	3·59	48·36	44·81
Wanganui	1·35	6	0·52	2·70	36·62	36·11
Foxton	1·35	6	0·52	2·67	29·35	32·51
Wellington . ..	0·89	9	0·34	2·84	38·62	41·08
South Island.						
Westport	10·11	12	3·74	8·45	96·62	96·80
Greymouth	14·06	14	4·22	8·72	103·10	101·55
Hokitika	11·08	15	2·39	10·44	124·42	115·24
Ross	17·74	14	3·77	11·99	157·50	135·49
Arthur's Pass ..	21·87	11	..	14·34	181·09	161·91
Okuru, South Westland	..	..	..	11·14	..	144·47
Collingwood	6·15	12	2·84	8·21	83·53	95·74
Nelson	2·42	6	1·22	2·98	32·38	37·84
Spring Creek, Blenheim	0·93	7	0·34	2·14	19·60	30·28
Hanmer Springs ..	4·12	11	1·31	3·94	32·21	45·30
Highfield, Waiau ..	2·59	8	0·87	2·67	22·28	33·28
Gore Bay	3·28	8	1·70	2·66	24·23	31·27
Christchurch	2·96	12	0·82	2·15	18·85	24·99
Timaru	3·31	10	1·77	2·43	20·00	22·64
Lambrook Station, Fairlie	2·43	7	1·19	2·54	23·83	24·87
Benmore Station, Clearburn	2·76	9	1·14	2·31	24·86	24·64
Oamaru . ..	2·32	12	0·87	2·24	21·36	22·01
Queenstown	3·37	10	1·32	2·53	31·50	30·46
Clyde	1·56	7	0·43	1·79	16·91	15·22
Dunedin	1·86	17	0·38	3·54	34·85	36·77
Wendon	3·66	9	0·95	2·78	32·11	29·96
Gore	..	..	..	3·29	..	34·34
Invercargill	3·30	15	0·83	4·07	48·95	45·75
Puysegur Point ..	3·93	16	0·74	7·14	76·70	85·26
Half-moon Bay ..	3·53	13	0·84	5·01	60·08	58·79

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT FOR DISTEMPER IN DOG.

W. S. S., Masterton :—

About five weeks ago a sheep-dog, aged seven years, fell sick with a sort of pneumonia, discharge of yellowish matter at nostrils, and severe stomach pains. I managed to nurse him through (whatever the illness was), and have been giving him cod-liver oil, but he has developed a "chattering of the jaws" when he is asleep as well as awake. He is working all right, but does not seem able to shake off this snapping of the teeth. Could you give me a remedy ?

The Live-stock Division :—

Your sheep-dog has been affected with distemper. A sequel to distemper is what is known as chorea, the nervous symptoms of which are characterized by twitching of certain muscles or groups of muscles. In this case the muscles of the jaws are affected and this accounts for the "chattering" movements described in your letter. Chorea in dogs does not rapidly respond to treatment. It is advisable not to overwork the dog, to give as much rest as possible, and to provide a dark quiet sleeping-kennel. In addition, the following mixture may be given in doses of one tablespoonful every night for a few weeks. After using one bottle of medicine an interval of a week is advisable before repeating the mixture The mixture is prepared by adding two drachms of iodide of potassium and two drachms of sodium bromide to an 8 oz. bottle of distilled water. This medicine may be obtained from any chemist. A gradual improvement should be anticipated rather than an immediate cure.

GOOSE-GRASS IN YOUNG PASTURE.

G. M., Willowbridge :—

In the spring of last year I sowed three bushels of Hawke's Bay certified mother seed with an oat crop. There is a large amount of goose-grass showing since the ryegrass has come out in ear. How can I eradicate the goose-grass ? Would you advise me to cut it before the seed ripens ?

The Fields Division :—

In cases in which farmers have reported the presence of goose-grass early, and have taken the advice to graze for the first season instead of endeavouring to save a seed crop, the results have been quite good, and the goose-grass was prevented from running to seed and the next season the crops were almost pure rye-grass Goose-grass seed can be dressed out of rye-grass and for that reason you may harvest the crop. Some goose-grass seed may fall, but if you keep the field grazed next season you will find very little goose-grass will be in evidence in the future in your pasture.

DIETETIC TROUBLE IN PIGS.

J. H. A., Mangatoki :—

I am having trouble with some of my pigs. They appear to be unsteady on their feet, and sometimes go down as though they had a big weight on their back, frequently kneeling on the ground. Their food consists of grass, whey, and a little meat-meal. Advice would be appreciated. Note.—The boar was the same when he was young. Would that have anything to do with it ?

The Livestock Division :—

Your pigs are apparently affected with a form of rickets bordering on paralysis. Young pigs require more minerals and more protein in their diet than older pigs. It is advisable, therefore, to increase the ration of meat-meal per head daily, and it is also necessary to see that the pigs have a run on green pasture. In all probability the boar was affected in the same way when younger. The condition is a dietetic one, an improved food-supply bringing about recovery.

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A REVIEW OF GRASS FARMING IN NEW ZEALAND.

THE BASIS OF DEVELOPMENT, PRESENT STATUS AND PROSPECTS.

A H. COCKAYNE, Assistant Director-General, Department of Agriculture

[Portion of 1933 Presidential Address to the New Zealand Grassland Association at Christchurch]

THE present is a most momentous period in the history of New Zealand grassland development. In the past the position has been clear enough, and it is perhaps as well to epitomize the stages of development through which it has passed so that the essential problem of the present one can be brought into reasonable perspective.

1. The first phase in New Zealand grassland history was represented by the exploitation of the natural grasslands, the open country being naturally first brought under stock control.

2. The second phase represented the replacement of natural units of vegetation by artificially produced grassland, largely without ploughing—a phase originally viewed essentially as a prelude to development along the line of arable farming extension.

3. The third phase was the real recognition that our climate, for the most part essentially a rain-forest-producing one, is therefore particularly adapted for the artificial development of artificially controlled permanent high-producing grassland. It is this recognition that has in the past definitely moulded the major agricultural policy of New Zealand along the line of grassland farming, and more and more along the line of the most intensive type of such farming—namely, the production and utilization of permanently milk-producing pastures. Thus the dairy cow, the ewe, and the sow represent in our intentional development the essential elaborating machinery for our grass crop, and butterfat and rapidly maturing meat the essential products. It has been on this basis that our grassland potentialities have been framed—the extension of milk-producing pastures to their utmost ; and their utilization to their utmost has become the established major agricultural intention of New Zealand. The acceptance of this third phase of grassland development carried with it the recognition of the great potentialities of New Zealand increasing her grass crop and improving the utilization of this great crop by the adoption and standardization of grassland practice based

on the critical interpretation of developing experience buttressed by investigation and research enabling such interpretation to be accurate. The recognition that the possibilities ahead of scientifically directed grassland management were extensive has virtually become stereotyped into two current expressions—" We have only scratched the surface," and " External markets are limitless," the last one, indeed, having become more and more circumscribed into " Great Britain can consume all we can produce."

The acceptation of these two statements has unfortunately tended towards the capitalization, largely with borrowed money, of our grassland potentialities well ahead of their realization ; this would be of no moment if our easily realizable expansion were allowed full play, but otherwise becomes serious and may necessitate considerable modification of our agricultural policies.

The statement that we have merely scratched the surface so far as grassland progress is concerned remains true enough, but its important corollary, making deeper scratching logical, that there are rapidly expanding markets for all that can be produced has been questioned.

It is the questioning that the practical potentialities of full grassland production are greater than the practical potentialities for consumption that necessitates a review of our grass-farming concepts, and particularly does it necessitate a wider outlook on the part of all our investigational and research grassland workers than hitherto when the statement went unquestioned. Personally one is inclined to think of the rather world-wide conception that agricultural production—*i.e.*, essentially along the line of foodstuffs—should be curtailed rather than expanded as being basically unsound so far as the welfare of humanity is concerned, and that a conception which is basically unsound cannot be permanently integrated into civilization. It may, however, be necessary, purely as a temporary measure, for it to be adopted for the special purpose of creating scarcity as a prelude to the necessity of again furthering expansion. But this looks to be a clumsy method of approach. So far as grassland is concerned there have been no revolutionary discoveries that would tend toward the replacement of live-stock as food and clothing elaborators, poor as they undoubtedly are in this direction when one bears in mind that our 80,000,000 tons of grass in New Zealand become " Bovrilized " down into 300,000 tons of meat, less than 200,000 tons of butterfat, and 100,000 tons of wool—a dry-weight matter production that could be secured by 500,000 acres of wheat instead of the 30,000,000 acres of grassland. One has always viewed the danger to grassland expansion as coming from bringing about the elimination of the double handling, as it were, that takes place in the production of animal foodstuffs rather than through the creation of 30,000,000 unemployed and their families becoming short of food. One feels that under expansion, still-stand, restriction, or what you will, the necessity for better grassland knowledge, better and increasing grassland research, that will lead to better efficiency in grassland management, remains of paramount importance and becomes even more essential so far as New Zealand is concerned under still-stand or slow extension than it would be under

rapid expansion. The main point, however, is that research and investigation under the former circumstance of necessity must be oriented on a philosophy differing appreciably from that based on the expectation of rapid perpetual expansion where increase in production has been the essential and almost the only viewpoint in the attempted solution of nearly all grassland problems. What is now needed is the getting-down to the real fundamentals, both individual and national, of *efficiency* in grassland management, rather than assuming, to the extent that has been done in the past, that volume increase is essentially the index whereby efficiency should be measured. One, however, rather feels that under semi-developed conditions such as largely exist in New Zealand increased efficiency automatically means larger increase in production, but that in itself is a matter for investigation. Just what constitutes individual and national grassland management efficiency, either separately or in combination or co-operation in the light of a definite rather than an expanding output, certainly looks to me a philosophical economic problem on which we should have definite knowledge, and that such knowledge should more or less control the development of research progress and be equally applicable under expansion. In this connection, might I express the opinion that, linked up with grassland management from the national viewpoint, the question of widening rather than narrowing the scope of grassland products is one of perhaps far-reaching importance. In one small particular in this respect I hope the conference will be constructive— namely, with regard to pedigree pasture seed growing where the inter-relation of production, certification, and marketing are all of particular significance. Apart from economic considerations, there are a few features in connection with grassland that I should like to place before you.

(1) The Variability of Butterfat Production per Cow from Season to Season.

During the past season nearly 50,000,000 lb. of butterfat beyond that of the previous one were produced, and the average production per cow milked increased by perhaps nearly 20 lb., although the average age of cows was less. This looks to me a wonderful illustration of the effect of a better supply of feed during the season, brought about by the combined influence of climate and the carrying-out of a generous top-dressing programme, and indicates that the quantity and quality of grass has not as yet reached the point of securing anything like maximum returns from our cows. In other words, our cows tend to be better than the feed that is supplied them, and I should judge the same applies to the ewe and the sow. This, to my mind, indicates that the actual feed management in grassland practice is capable of considerable improvement, and being essentially connected with efficiency, is a question on which more definite and reliable data than we possess should prove of value. A difference of 20 lb. per cow now that we are probably milking not less than 1,800,000 cows represents no small figure—over 16,000 tons of butterfat, a plus or minus quantity that so far as production is concerned exceeds any quota restriction that has been suggested; and a difference of 5 per cent. in lambing brought about by better ewe nutrition would mean three-quarters of a million additional lambs.

(2) The Artificial Maintenance of Grassland to a Wet-stock Standard.

Wet-stock standard grassland represents green, rapidly growing, long-season production, broad-leaved grassland; and the great potentially ahead of New Zealand grassland farming is the very large area, running into millions of acres, that is climatically suited to the production of such type of grassland, but from the natural-soil standpoint is unsuitable, and the great development in recent years has been the translation of much of such country from dry-stock to wet-stock standard by the veneering of the surface with a film of phosphate irrespective of the fertility or, rather, lack of fertility, of the soil itself. Nothing perhaps is more striking in New Zealand, where rainfall is well distributed, than the presence of adjoining paddocks, one wet-stock type with its artificial phosphate veneer, and the other soil (nutritionally) dry-stock country, where top-dressing is not carried out. During the past three years the truth of the surface-fertility theory (the artificial phosphate veneer theory) in the maintenance of grassland to a wet-stock standard in high rainfall districts has been wonderfully exemplified in the many thousands of acres of soil nutritionally dry-stock country—pumice country that has been grassed by the Fields Division of the Department in the Rotorua district. Within a single season from the natural scrub-covered condition it has been converted into essentially perennial rye-white clover pasture of high production, permanent, provided the veneer of phosphate is kept renewed, the country is adequately stocked to provide consolidation, and that certified seed has been used. So far as the actual milking-season is concerned, and not taking into consideration the wintering of the stock, such pastures two years old have yielded over 200 lb. of fat per acre, putting them in the front rank of production. Now, particularly in the North Island, there are very large areas of virgin land and very large areas of dry-stock grassland that are capable of similar and rapid response. Probably one of the most difficult questions to determine in New Zealand—with any deliberate slowing-up of production—is just to what degree permanent artificial maintenance of grassland to a wet-stock standard is nationally sound. It is probably the most outstanding grassland problem of the immediate future, but it is nationally economic in character and has little reference to management, which is rapidly becoming standardized on the basis of critically interpreted experience, and is therefore scientifically sound so far as climatically suitable but soil-unsuitable potential wet-stock grassland is concerned.

The position, however, is quite different with respect to climatically unsuitable but, perhaps, soil-suitable wet-stock grassland. Here the artificial factor that must be under control leading to a permanent maintenance of grassland to a wet-stock standard must clearly be irrigation of some sort or another; but on this the economics, the management, and the nationally significant features are none of them in any degree standardized. I view, however, the work being done in the South Island, particularly that in Canterbury, as of very special value concerned as it is with the artificial maintenance of grassland otherwise capable only of maintaining dry stock. Here, however, the veneer must be an intentionally added-water one, while

in the rainfall areas it is a plant-food one; but the essential feature of both is that the application is a surface one—the development point of the renewable rooting system characteristic of wet-stock grassland.

(3) THE DEVELOPMENT OF SEED CERTIFICATION.

The experience of the past three years would indicate that pasture-seed certification under proper scientific supervision is sound, and the work in New Zealand has attracted world-wide attention from grassland workers. So far as perennial rye-grass goes, it has been spectacular; a few thousand bushels certified three years ago—nearly 300,000 bushels in 1933. Its rapid development has brought marketing troubles, in the solution of which both producer and the seed trade must from the national standpoint work in the closest harmony and co-operation.

Pedigree grazing types of grass and clover seeds, or, shall I say, national mark pasture seeds, the standard under the strictest of scientific control, offers a field for external trade in which New Zealand might well assume leadership.

(4) THE VALUE OF LARGE NUMBERS OF OBSERVATIONAL PASTURE-TREATMENT PLOTS.

The value of this work has been amply demonstrated and the trend of effect of lime and potash is being placed in far better perspective. It is possible that soil-survey studies in co-operation with this work may be of very great value in lessening the number of trials and at the same time increasing the practical application that may be derived from them. The value of this work in connection with economic studies as to the practical limits of artificial maintenance of wet-stock standard grassland is of particular significance.

(5) GRASS AS A MAJOR FACTOR IN PORK-PRODUCTION.

The remarkable results that have been secured by the Waikato Pig-recording Club in a study of the value of pasture grazing in the production of pork make it imperative that this phase of grassland management should be put under intensive study. At the present time we know little, if anything, of the pruning reaction effects of grazing grassland by pigs, and this is a matter that requires close investigation so that standard methods of pig-grazing from the optimum standpoint both of the pig and the pasture may be formulated, and the sow added to the dairy cow and the ewe as an important grass-crop elaborator; one is apt to view the pig with disdain, but can we afford to do so when even now in meat tonnage its export nearly equals a million lambs.

(6) SOME EXAMPLES OF APPLICATION BECOMING STANDARD IMMEDIATELY FOLLOWING RESEARCH.

One of the most distressing features with regard to much research is the time that follows and the difficulties that are experienced in getting research teachings put into practice. During the past two years, however, there have been some remarkable instances to the contrary, amongst which can be mentioned:—

1. Limonite now being used by the truckload in districts where bush sickness has been prevalent, and where it has up to the present largely limited grassland utilization.

2. Over 400 tons of sodium chlorate were used last season in ragwort destruction, and the amount is limited only by the price.

3. Nearly all the lucerne established last season—4,000 to 5,000 acres—has been inoculated with material provided by the Plant Research Station at a cost to the farmer of 1s. per acre.

4. Where perennial rye-grass is required in mixtures in the North Island, certified seed is almost exclusively used.

These examples carry with them important principles which seem to govern the rapid implementing of research into practice. They would look to be three in number :—

1. To impress the farmer that a certain practice is sound by actual illustration under *farm environment*.

2. Simplification to the point that there is no variant or alternative.

3. To provide the essential material or materials in an easily procurable and usable form.

Examples such as these likewise indicate the close connection that should be maintained between research on the one hand and instruction on the other, and the necessity for research to be translatable into what is really practical and not theoretical instruction. One has rather the feeling that grassland research tends to become in its progress too often directed more and more towards the science concerned than to the art into which it must be incorporated if rapid practical translation is to be secured.

THE CONTROL OF MOULD FUNGI IN DAIRY FACTORIES AND MEAT-WORKS.

J. C. Neill, Field Mycologist, Plant Research Station, Palmerston North.

One of the first precautions to be taken in the control of moulds on manufactured foodstuffs is to eliminate, as far as possible, sources of infection located on the woodwork and utensils of the factory. The methods commonly adopted for this purpose vary greatly, and little or no experimental evidence is available as to their relative value.

The series of laboratory experiments herein recorded, while necessarily tentative and to be regarded only as preliminary to a more thorough investigation, provide indications which have an immediate practical value. The chief of these is the apparent inefficiency of the widely used chlorine disinfectants as controllants of mould colonies established on woodwork. Formalin gave the best results of the chemicals tried, but, to be effective, it was necessary to allow it to operate in a closed atmosphere and at fairly high concentration. For practical use the most promising indications were given by hot water, applied for as long a time and at as high a temperature as practicable, preferably accompanied by vigorous scrubbing. The experiments also indicated that it is more difficult

to suppress mould colonies established on a rough unplaned surface than it is when the surface is smooth and that the longer established the colonies the more difficult they are to control.

EXPERIMENTAL METHOD.

Small blocks of unseasoned white-pine timber were used for culturing the moulds. These were smooth planed on top and sides but left rough as sawn at the ends. The blocks were placed on wet pads in petri dishes and, after being sterilized, were inoculated with spores from pure cultures of the various moulds. For series 1 the blocks were incubated for five to six days at 21° C., the colonies being then clearly defined, about 1 in. in diameter, and confined to the point of inoculation on the upper surface of the block. For series 2 the colonies were allowed to develop for from fifteen to eighteen days, having then spread on to all exposed faces of the blocks. Following treatment the blocks were reincubated in sterile petri dishes and examined at intervals up to three weeks. All tests were made at least in duplicate and repeated when not in agreement.

SERIES 1.—USING RESTRICTED MOULD COLONIES CONFINED TO UPPER SURFACE OF BLOCKS.

Experiment 1.

The moulds used were *Penicillium puberulum*, *Penicillium expansum*, *Cladosporium herbarum*. The solutions used were sodium carbonate, 10 per cent.; trisodium phosphate, 5 per cent.; borax, 5 per cent.; proprietary chlorine sterilizer No. 1; formalin, 1 part of formalin containing 38·5 per cent. formaldehyde to 20 parts of water; soft soap, 5 per cent., alone and in addition to the other materials Blocks were dipped momentarily, and the colony rubbed with a cotton-wool swab soaked in the solution. The controls were rubbed with cold water only.

The results may be stated as follows: The formalin solution both with and without soft soap completely inhibited renewed sporulation of all three moulds. The borax solution inhibited renewed sporulation of the *Penicillia*, but failed to do so with the *Cladosporium*. Proprietary chlorine sterilizer, sodium carbonate, trisodium phosphate, and soft soap all failed to control the moulds, the two latter, in fact, showing stronger renewed growth and sporulation than blocks rubbed with cold water only.

Experiment 2.

These tests were conducted with the black-spot mould *Cladosporium herbarum* only. This mould is very common on the surface of wood subjected to conditions of high humidity. It has frequently been observed growing and fruiting on the walls, rafters, shelving, vats, &c., of dairy factories and meat-works, and it has been recorded as one of the chief spoilage moulds of unsalted butter(1), and of frozen mutton and chilled beef(2). The hyphæ of this mould have dark walls, and appear to penetrate more deeply into the timber than do the hyphæ

of such moulds as the *Penicillia*, leaving in consequence a dark stain which cannot be rubbed off. The results are indicated in the appended table :—

Blocks dipped momentarily and Colonies rubbed with Swab soaked in the Solution.

Solutions.	Renewed Sporulation in Three Weeks.
Formalin (38·5 per cent. formaldehyde)—	
1 part to 20 parts water	None.
1 part to 50 parts water	None.
1 part to 100 parts water	Delayed and weak.
1 part to 150 parts water	Delayed and weak.
1 part to 200 parts water	Delayed.
1 part to 250 parts water	Mode ate.
1 part to 300 parts water	Vigorous.
Copper sulphate (crystals)—	
2 per cent.	None.
1 per cent.	None.
0·2 per cent.	Weak.
0·1 per cent.	Moderate.
0·02 per cent.	Vigorous.
0·01 per cent.	Vigorous.
Borax 5 per cent.	Delayed and weak.
Boric acid, 5 per cent	Delayed and weak.
Borax 1 per cent plus boric acid 4 per cent.	Delayed and weak.
Borax 1 per cent. plus boric acid 3 per cent.	Delayed.
Borax 1 per cent plus boric acid 2 per cent.	Moderate.
Borax 1 per cent. plus boric acid 1 per cent.	Moderate.
Borax 4 per cent. plus boric acid 1 per cent.	Delayed and weak.
Borax 3 per cent. plus boric acid 1 per cent.	Delayed.
Borax 2 per cent. plus boric acid 1 per cent.	Moderate
Borax 2 per cent. plus boric acid 3 per cent.	Delayed and weak.
Borax 3 per cent. plus boric acid 2 per cent.	Delayed and weak.
Common salt—	
10 per cent.	Very vigorous.
5 per cent.	Very vigorous.
Saltpetre, 10 per cent	Very vigorous.
Chlorine compounds—	
Proprietary compound No. 2	Moderate.
Proprietary compound No. 3	Vigorous.
Proprietary compound No. 4	Vigorous.
Eusol (0·4 per cent. chlorine, 1·25 per cent. boric acid)	Vigorous.
Dakin's No. 1 solution (0·5 per cent. chlorine, 0·4 per cent. boric acid)	Vigorous.
Dakin's No. 2 solution (0·5 per cent. chlorine)	Vigorous.

In this experiment renewed growth of the black-spot mould was prevented by formalin at 1 to 20 and 1 to 50 and by copper sulphate at 2 per cent. and 1 per cent. Borax and boric acid gave partial control only. Common salt and saltpetre at 10 per cent. appeared to stimulate the mould. The outstanding result of the experiment was the complete failure of the chlorine disinfectants to control the growth and renewed sporulation of the mould.

Experiment 3.

The object of this experiment was to ascertain the effect of hot water on *Cladosporium herbarum*. Cultures of *Cladosporium* on wood blocks were immersed for 30 seconds in water held at various

temperatures. One block of each duplicate pair was rubbed with a cotton swab while under the water, the other being left undisturbed.

Table of Results of Hot-water Treatment.

Temperature, Fahrenheit.	Renewed Sporulation in Three Weeks.	
	Not Rubbed.	Rubbed.
61°	Vigorous	Delayed, later vigorous
124°	Vigorous	Delayed, later moderate.
128°	Moderate	Delayed, later slight
130°	Moderate	Delayed, later slight.
132°	Slight	None.
134°	None	None.
136°	None	None
138°	None	None.
140°	None	None
142°	None	None
144°	None	None.
146°	None	None.
150°	None .. .	None

These results indicate that thorough washing with hot water is an effective method for the suppression of the black-spot mould when growing on dressed white-pine timber.

SERIES 2.—USING DIFFUSE MOULD COLONIES DEVELOPED ON ALL EXPOSED FACES OF THE BLOCKS.

Experiment 4.

The object of this experiment was to ascertain the effect of formalin and ammonia in open and closed dishes on *Cladosporium herbarum* and *Penicillium expansum.* Since the previous tests with formalin were carried out in a closed atmosphere only, the following experiment was designed to compare its effect when the treated blocks were freely exposed, thus more nearly representing normal factory practice. A parallel series was also carried out with ammonia, since this has been suggested as a substitute for formalin for the control of moulds in the presence of foodstuffs.

The blocks were immersed momentarily in solutions of formalin and of ammonia, without rubbing, transferred to sterile petri dishes, and incubated for three weeks. Duplicate sets of blocks were used, the dish lid not being replaced for forty-eight hours following treatment with one set and being replaced immediately with the other.

In this experiment neither mould was controlled completely by formalin solution at a strength of 1 to 20 when exposed in open dishes following treatment, although renewed sporulation took place only on the rough surfaces of the blocks. A closed atmosphere is apparently necessary to ensure the full fungicidal effect of formalin. The action of ammonia on the black-spot mould was very similar to that of formalin, though less effective, but it had no apparent effect on the blue mould.

Table of Experimental Results.

Solutions used.	Renewed Sporulation in Three Weeks.			
	Cladosporium herbarum.		*Penicillium expansum.*	
	Open Dish.	Closed Dish.	Open Dish.	Closed Dish.
Formalin 38·5 per cent —				
1–20 water ..	Trace on ends	None ..	Trace on ends	None.
1–30 water ..	Trace on ends	None ..	Trace on ends	Trace on ends
1–40 water ..	Moderate ..	Slight ..	Moderate on ends	Slight on ends
1–50 water ..	Moderate ..	Slight ..	Vigorous ..	Moderate
1–75 water ..	Vigorous ..	Moderate ..	Vigorous ..	Vigorous
1–100 water	Vigorous ..	Vigorous ..	Vigorous ..	Vigorous
Ammonia (specific gravity, 0·882)—				
1–20 water ..	Moderate ..	Trace on ends	Vigorous ..	Vigorous
1–30 water ..	Vigorous ..	Slight ..	Vigorous ..	Vigorous
1–40 water ..	Vigorous ..	Slight ..	Vigorous ..	Vigorous
1–50 water ..	Vigorous ..	Vigorous ..	Vigorous ..	Vigorous
1–75 water ..	Vigorous ..	Vigorous ..	Vigorous ..	Vigorous
1–100 water	Vigorous ..	Vigorous ..	Vigorous ..	Vigorous

Experiment 5.

The object of this experiment was to ascertain the effect of hot water for 5 seconds on colonies of *Cladosporium herbarum.* In experiment 4, above, on the effect of hot water on the black-spot mould, the blocks were dipped for a period of 30 seconds. In the present experiment this period was reduced to 5 seconds, as more nearly representing the time during which the temperature of water used in hosing down could be maintained in contact with the woodwork. The conditions of this experiment also varied in that the mould colonies were older and had become established on the rough ends as well as on the smooth faces of the blocks. A series of temperatures was used, rising by 5° from 140° F. to 195° F., and the colonies were not rubbed.

The results showed that, under these conditions, a water temperature of 185° F., or over, was necessary to prevent renewed growth and sporulation on the rough surfaces. On the smooth surfaces no renewed growth took place following dipping at temperatures of 165° F. or over.

Experiment 6.

The object of this experiment was to ascertain the effect of a steam jet on colonies of *Cladosporium herbarum* and *Penicillium expansum.* A jet of steam from the relief valve of an autoclave at 25 lb. pressure was allowed to impinge for 3 seconds on the surfaces of blocks bearing black-spot mould and blue mould.

The temperature gradient for the steam outward from the point of issue was first ascertained and the blocks held at distances corresponding to differences of 5° F. in temperature. They were then transferred to petri dishes and incubated for three weeks. Four replications were made of each treatment.

The results indicated that at steam temperatures of 165° F. or over no renewed growth took place with either mould when growing on a smooth surface of the block. On the rough ends, however, regrowth took place even after treatment for 3 seconds with steam at 195° F.

General Summary.

Laboratory tests of various materials for the suppression of species of *Cladosporium* and *Penicillium* established on wood showed that the commonly used chlorine disinfectants were ineffective for this purpose.

Copper sulphate and formaldehyde proved effective, but the latter required a closed atmosphere for full efficiency. Hot water accompanied by rubbing gave the best practicable control. The relative roughness of the wood surface and the degree of establishment of the mould colonies materially affected the degree of control obtained.

References.

(1) Morgan, G F V, *N Z Dept Agr Bull*, 149, 1930
(2) Brooks, F T, and Kidd, M N, Report No 6, Food Investigation Board, London, 1921

RETURNS FROM PIG FATTENING ON DAIRY FARMS.

W. Riddet and C. P. McMeekan, Massey Agricultural College.

It has become so customary in New Zealand to consider milk from the point of view of the butterfat it contains that the value of its other solids is too often overlooked or underestimated. On dairy farms practising home separation of milk the sales of cream form the greater part of the revenue. The cream, however, represents about only 10 per cent. of the weight of the milk from which it is produced, and, although it accounts for 97–98 per cent. of the butterfat produced by the herd, there remains in the separated milk a trace of butterfat and the bulk of the non-fatty solids. These solids have a high food value. An average sample of separated milk contains approximately 9·5 per cent. solids. In its liquid form separated milk is not saleable, and the extraction of the solids on the farm is not economically possible. Thus its value to the farmer depends on its optimum utilization as a food for some productive animals, such as pigs, calves, or poultry. Cheesemaking utilizes more of the solids of milk than butter-manufacture. Nevertheless, fully 40 per cent. of the original milk solids passes into the whey, and, although these have a smaller food value than those in the separated milk, they have still quite an appreciable recoverable value when properly utilized.

The Food Value of Separated Milk and Whey.

Purely from a dietetic viewpoint, separated milk is more valuable for growing than fattening animals. Its relatively high content of protein makes it a most useful supplementary food for young animals. As a fattening food it is, theoretically, too rich in proteins, but this

can be corrected easily by feeding with it suitable cereals such as barley, maize, and oats. However, in the dairying districts of the North Island of New Zealand, where these cereals are generally too expensive for conversion into animal products, economic considerations must in practice take precedence to nutritional ideals, and valuable protein substances in milk have to be used for the less valuable purpose, nutritionally, of fattening, since dairy by-products are essentially waste materials in the manufacture of dairy-produce and they are worth only as much as can be made out of them.

The food value of buttermilk, undiluted with water, is much the same as skim-milk. Whey is a less valuable food than either separated milk or buttermilk; it is deficient in protein by reason of the extraction of casein in the cheesemaking process, and it also contains less lime and phosphates than separated milk. Thus, by itself, whey is not a safe food as a sole diet for stock, but its deficiencies can readily be made up by the feeding of a small amount of suitable supplement such as meat-meal with it, and by giving the animals access to good short pasture.

Pigs as Users of Dairy By-products.

Pigs are the most convenient animals for the disposal of these foods. They fatten quickly and their numbers can be fairly easily adjusted to the supply of available by-products by good management. At the present time there is a good demand in Britain for Dominion pig-products, and provision has been made by the British Government for the extension of this trade. In any development of the industry, however, in the dairying districts of New Zealand, it must be recognized that dairy by-products must, under existing economic conditions, form the bulk of the food. It can be shown by calculation that, after making allowance for the upkeep of breeding-stock, about 42 lb. pig-flesh (dead weight) can be produced from the separated milk remaining after extraction of 100 lb. butterfat from whole milk. This figure is practically the same for both baconer and porker production, the smaller feed requirements of the latter per unit of weight increase being offset by the greater sow feed overhead. It can also be shown that there can be produced from the buttermilk resulting from the manufacture of 1 ton of butter, 48 lb. of pig-flesh. The possible returns from whey work out at fully 21 lb. of pig-flesh per 100 lb. butterfat in the milk.

From a farming viewpoint the immediate cash returns from the rational fattening of pigs on unsaleable skim-milk is of material benefit to dairy-farmers. In addition, there are other equally great advantages. Firstly, the pig returns to the farm a considerable amount of manurial residues; it passes off in excreta and urine substances from the milk not used for fattening and growth in a form readily available as fertilizers. Thus, part of the fertility of the farm depleted by the cows is returned by the pigs. Herein lies one of the important points in making the pig area mobile, and ensuring that the whole farm derives benefit from the pig droppings. Secondly, the pig is a soil-improver, not only by virtue of its manure, but also by its consolidation and in some cases tillage efforts. Thirdly, it can utilize grass, thereby providing a means of using feed in places

not of material value to other classes of stock. Fourthly, the price of pig-products is independent of dairy products, and it sometimes happens that a lean year in butterfat prices can be eased by good prices for pigs. Finally, the pig plays an important part in determining farm efficiency, and it is suggested by the data presented herein later that no index of butterfat per acre is satisfactory without a complementary statement of the pig-flesh produced per 100 lb. butterfat.

From a Dominion viewpoint it should be possible to produce from dairy by-products, on the basis of the butter and cheese manufactured in the season 1932–33, approximately 72,500 tons pig-flesh, or fully 1,500,000 carcasses of equal numbers of baconers and porkers.

Actual Production Results on Dairy-farm.

Prompted by the above possibilities, the Manawatu-Oroua Pig Recording and Development Club conducted a farm survey of the results obtained from pig-fattening on a number of farms in the Manawatu district in the dairying season 1932–33. The material to follow represents the results of the survey, which was conducted with the object of (*a*) obtaining reliable data upon the present position of pig-raising in relation to dairying in the Manawatu district, and (*b*) obtaining information of practices yielding the best results.

Collection of Data.

The co-operation of a large number of interested farmers was enlisted, some sixty farms in all being covered in the survey. Of these only eleven were found suitable for the purposes required, and form the basis of this analysis. The remainder were unable to furnish sufficient detailed information. The results obtained should be regarded as representing the best farms available, being farmed by keen men.

Records were collected of the total weight of pig-flesh produced in terms of dead weight, allowance being made at estimated weights for pigs carried over from the previous season, pigs on hand at end of season, and pigs purchased; of the number of sows carried and pigs reared on the farm; of the farm area and the total amount of butterfat produced; of the number of cows milked and calves reared; and of the amounts and types of supplementary pig-feed used. Each farm was visited by the recording officer when necessary during the season and every care taken to verify all data.

Method of Statement of Results.

Returns from pig-fattening in relation to dairying may be stated in several ways:—

(*a*) The production of pig-flesh per 100 lb. butterfat.

(*b*) The production of pig-flesh per cow.

(*c*) The production of pig-flesh per acre.

(*d*) The gross cash returns per pound of butterfat and per cow with pig-flesh at varying prices.

(*e*) The cash returns per pound of butterfat and per cow, deducting the cost of purchased foodstuffs, with pig-flesh at varying prices.

All these indices have been used in the following analysis. For the purpose of comparing relative efficiencies of pig management it is suggested that "pig-flesh per 100 lb. butterfat" is the best single index available. On the average dairy-farm the function of the pig is not to consume the produce of the land, but to consume the produce of the cow. An index, therefore, which expresses the production of the pig in terms of the production of the cow is logically sound. On these grounds "production of pig-flesh per acre" is ruled out, while at first sight "production of pig-flesh per cow" might be considered of equal value to the index selected. It will be shown later, however, that unless considered in relation to the butterfat yield per cow, "pig-flesh per cow" is not as significant a measure of pig-management efficiency as "pig-flesh per 100 lb. butterfat." "Gross cash returns" and "Cash returns over meal costs" have also obvious defects, since they are governed largely by market price fluctuations.

Types of Farms.

All the farms covered practised home separation, the skim-milk produced being fed to calves and pigs. They represent a wide range of farm area—from 31 acres to 428 acres (Table 2) and of cows milked—from 20 to 300. The majority, however, range from 50 to 100 acres and from 30 to 60 cows. Though the number is small, they are in respect of cow numbers and farm area fairly typical of dairy-farms of the district.

Results obtained.

(*a*) *Average Returns.*

Table 1 summarizes the position in respect of the eleven farms.

Table 1.—Summary of Pig-production Figures.

Number of Farms.	Number of Cows.	Number of Acres	Butterfat produced.	Pig-flesh produced.	Pig-flesh per 100 lb. Butterfat.	Pig-flesh per Cow	Pig-flesh per Acre.	Calves per 100 lb. Butterfat.
			lb.	lb.	lb.	lb.	lb	
11 ..	755	1,142	180,230	62,968	34·9	83·4	55·1	0·1

		lb.
Highest yield pig-flesh per 100 lb butterfat	..	48·0 + 0·083 calves.
Lowest yield pig-flesh per 100 lb. butterfat	..	22·0 + 0·087 calves.
Highest yield pig-flesh per cow	.. ..	136·6
Lowest yield pig-flesh per cow	.. ..	55·8
Highest yield pig-flesh per acre	.. ..	88·3.
Lowest yield pig-flesh per acre	.. ..	33·5.

	Pig-flesh per 100 lb. Butterfat. lb.	Pig-flesh per Cow. lb.
Highest ratio sows to cows 1 : 5	43·8	131·3
Lowest ratio sows to cows 1 : 16	22·0	58·3
Highest yield average butterfat per cow—300 lb. ..	45·5	136·6
Lowest yield average butterfat per cow—201 lb. ..	27·7	55·8

Highest gross return with pork at 4d. per pound—£2 5s. 6d. per cow; 1·92d. per pound butterfat.

Lowest gross return with pork at 4d. per pound—18s. 7d. per cow; 0·88d. per pound butterfat.

It will be seen that a total of 180,230 lb. of butterfat and 62,968 lb. of pig-flesh was produced, representing an average production of 34·9 lb.

of pig-flesh per 100 lb. of butterfat, 83·4 lb. per cow, and 55·1 lb. per acre. In addition, an average of one calf per 1,000 lb. of butterfat was reared. Valuing this production at 4d. per pound of pig-flesh, the average gross return from pig-raising was 1·4d. per pound of butterfat and £1 7s. 9d. per cow.

(b) *Individual Returns.*

Comparisons between the best and the worst farms indicate that wide differences occurred (Table 1). The production of pig-flesh on the worst farm per 100 lb. of butterfat was 22 lb. and on the best 48 lb., the proportion of calves reared being roughly the same in each case. This represented a difference of approximately 120 per cent. The margin on a per-cow basis was even greater—from 55·8 lb. to 136·6 lb., or a difference of 143 per cent., and greater still on a per-acre basis—from 33·5 lb. in the lowest to 88·3 lb. in the highest, or a difference of 163 per cent. On a valuation basis, the significance of these differences is apparent. With pig-flesh at 4d. per pound the gross cash returns varied from 1·92d. per pound of butterfat and £2 5s. 6d. per cow on the best farms to 0·88d. per pound of butterfat and 18s. 7d. per cow on the worst.

Table 2 sets out the production figures of the indivudual farms in greater detail.

Table 2.—Showing Pig-flesh Production Figures of the Individual Farms per 100 lb. Butterfat per Cow and per Acre in relation to the Production of Butterfat

Farm Letter	Pig-flesh per 100 lb Buttertat	Pig-flesh per Cow	Pig-flesh per Acre	Number of Calves per 100 lb. Butterfat.	Butterfat per Cow	Butterfat per Acre	Size of Farm.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	lb.	lb	lb		lb.	lb.	Acres
H ..	48·0	134·2	88·3	0·083	280	184	79
I ..	45·5	136·6	88·1	0·033	300	194	31
C ..	43·8	131·3	73·0	0·133	300	167	81
E ..	43·5	97·2	60·7	0·080	223	140	136
K ..	40·6	104·6	67·6	0·122	260	167	48
L ..	40·1	113·7	79·3	0·000	283	198	86
D ..	38·3	87·2	72·8	0·080	228	198	31
A ..	36·8	97·2	61·5	0·000	264	167	60
J ..	28·3	74·4	48·5	0·083	262	171	49
F ..	27·7	55·8	39·1	0·154	201	141	428
G ..	22·0	58·3	33·5	0·087	265	152	113

While the differences between the highest and the lowest farms are very great, six farms of the eleven produced over 40 lb. of pig-flesh per 100 lb. butterfat and five over 100 lb. per cow. Of the remainder only three have yielded relatively low returns, and, on these, production has been at about the same level. When it is remembered that many farms make no use whatever of dairy by-products, even these latter figures cannot be considered really poor results; all have produced very good returns. It will be noted that the figures of the best farms closely approximate that suggested as being theoretically obtainable.

In Table 2 the farms are arranged in order of " pig-flesh per 100 lb. butterfat." It will be noted that high production of pig-flesh in terms

of butterfat is associated generally with similar high production per cow and per acre. Farms with a production of 40 lb. and over per 100 lb. of butterfat all show over 100 lb. of pig-flesh per cow, while farms with a production of less than 40 lb. per 100 lb. of butterfat have all yielded less than 100 lb. per cow. The relationship is not absolute, however, as can be seen from farms E and A, which have produced the same amount of pig-flesh per cow (97·2 lb.), and yet different yields on a butterfat basis (43·5 lb. and 36·8 lb.). Similarly, the production of pig-flesh per cow of farms E, K, and L is in inverse order to that of their production per 100 lb. of butterfat. To a lesser degree this applies also as between farms H and I and farms F and G. Examination of column 5 (Table 2) suggests that differences in the production of butterfat per cow are responsible for these anomalies, and indicates that high production of pig-flesh per cow is not significant unless related to the production of butterfat per cow.

Factors in Pig Management contributing to High Production.

(a) *Butterfat per Acre.*

In increasing returns from the dairy-farm, farmers have been urged to aim at a high yield of butterfat per acre. It is claimed that this should be accompanied by a statement of good returns from the utilization of by-products such as a high yield of pig-flesh per 100 lb. of butterfat. In urging the importance of increasing pig production along with butterfat production, the relationship between the two indices should be noted. Since the major foodstuff used for pig production on the dairy-farm is skim-milk, the value " pig-flesh per 100 lb. of butterfat," assuming full and efficient utilization, should be relatively constant. Differences in " pig-flesh per 100 lb. butterfat " must be attributed to differences in efficiency of pig management or by-product utilization.

If high production of butterfat per acre is an index of efficient land utilization, and if pig-flesh per 100 lb. butterfat denotes efficiency of by-product utilization, the expression " butterfat per acre plus pig-flesh per 100 lb. butterfat " provides a convenient means of stating relative efficiency of dairy-farm production. Since pig-flesh per 100 lb. butterfat should be relatively constant the yield of pig-flesh per acre should be directly proportional to the butterfat production per acre; an increase in the latter should be accompanied by a proportionate increase in the former. While Table 2 shows a general relationship between butterfat per acre and pig-flesh per acre, high yields of both tending to be associated, indicating good management in one direction to be reflected in both, the relationship is not as above, since pig-flesh per 100 lb. butterfat has varied. Farms C and D, in illustrating this point, show also that " pig-flesh per acre " is unsatisfactory as an index of pig management unless considered in relation to " butterfat per acre." On these farms equal production of pig-flesh per acre has been obtained, but efficiency of production has not been the same, since farm D has a much greater yield of butterfat to the acre—a difference shown immediately by the pig-flesh per 100 lb. butterfat index.

(b) *Butterfat Yield per Cow.*

Columns 1, 2, and 5 (Table 2) show the relationship between pig-flesh per 100 lb. butterfat and per cow, and the average yield of

butterfat per cow. High butterfat average per cow is considered to be a measure of efficient cow management in dairying. Providing wide differences in test are not operating, the amount of skim-milk available should be roughly proportional to the butterfat yield per cow, and high yields of the latter should accordingly be reflected in high yields of pig-flesh per cow, and, if pigs are managed with equal efficiency, in high yield per 100 lb. butterfat. Fawcett's survey* suggests such a relationship, his figures based on cash returns showing that high cash returns from pigs are associated with high herd averages, indicating that efficiency in one direction is reflected in both. It is frequently stated, however, that the opposite is the case: that farms characterized by high butterfat averages per cow often show poorer pig returns than others due to differences in the emphasis of management, such farms concentrating on cow production at the expense of pig production. The figures referred to above provide evidence in support of both statements, indicating—

(1) *That where high production of pig-flesh is obtained it generally accompanies a high yield of butterfat per cow.* Thus the four best farms—I, C, H, L—on a pig-flesh per 100 lb. butterfat and per-cow basis have the highest average yield of butterfat per cow, ranging from 280 lb. to 300 lb.

(2) *That a high yield of pig-flesh does not necessarily accompany a high yield of butterfat per cow.* Thus Farm G has produced only 22 lb. of pig-flesh per 100 lb. butterfat and only 58·3 lb. per cow, although the average yield of butterfat per cow was 265 lb.

(3) *That a low yield of pig-flesh does not necessarily accompany a low yield of butterfat per cow.* Thus Farm E produced 43·5 lb of pig-flesh per 100 lb. butterfat and 97·2 lb per cow, although the average yield of butterfat per cow was only 223 lb

(4) *That while a higher yield of pig-flesh per cow is generally produced where the yield of butterfat per cow is high, the increase is not necessarily proportional to the increase in butterfat yield*—*e.g.*, farms E, K, L. While L has the highest yield of butterfat per cow and pig-flesh per cow it has the lowest yield of pig-flesh per 100 lb. butterfat.

These relationships indicate that, while high returns from pigs tend to be associated with high returns from cows, the amount of by-products available is not the principal factor involved; that some farmers make far better use of their by-products than others. They emphasize the importance of the management factor in securing good results, and that interest in the pig department of the farm plays a big part in efficient by-product utilization.

(c) *Ratio of Sows to Cows.*

Table 3 sets out the ratio of number of sows carried to cows milked on each farm, together with the number of pigs reared per sow and the proportion of store pigs bought.

Comparing these figures with the relative production of pig-flesh per 100 lb. butterfat, it will be seen that farms which have produced at a high level have carried more sows to cows milked than farms

* Fawcett (1929): *New Zealand Department of Agriculture, Bulletin No. 138*, p. 37.

Table 3.—Showing the Ratio of Sows to Cows, Number of Pigs reared per Sow, Proportion of Pigs purchased, and the purchased Concentrates used, in relation to the Production of Pig-flesh per 100 lb. of Butterfat.

Farm Letter.	Pig-flesh per 100 lb. Butterfat. (1)	Ratio Sows: Cows. (2)	Number of Pigs purchased as Percentage of Number sold. (3)	Number of Pigs reared per Sow. (4)	Total Meals used. (5)	Meals per 100 lb. Pig-flesh. (6)
	lb.				lb.	lb.
H ..	48·0	1 : 7	..	14·1	400	5·7
I ..	45·5	1 : 10	..	17·5	300	11·0
C ..	43·8	1 : 5	..	12·2	3,976	67·0
E ..	43·5	1 : 14	30	12·0	898	10·8
K ..	40·6	1 8	..	10·0	..	..
L ..	40·1	1 : 12	..	11·0	2,000	29·3
D ..	38·3	1 . 9	9	13·0	925	39·0
A ..	36·8	1 : 13	..	13·0	..	..
J ..	28·3	1 : 11	47	8·3	..	..
G ..	22·0	1 . 16	..	12·0	340	9·0

producing at a low level. The type of trade pursued—whether the pigs are carried to porker or baconer weights—will, of course, affect the number of sows carried. The wide ratio of farm E is apparently compensated for by the purchase of over 30 per cent. of the total pigs fattened. Farm I has a good production, but a fairly wide ratio, but the number of pigs reared per sow is greater than on any other farm. This would tend to offset the apparent disadvantage of a small number of sows to cows.

As would be expected, the number of pigs reared per sow evidently plays a part in high production, a narrow ratio of sows to cows combined with a large number of pigs reared tending to be associated with the best returns. Thus, although farm J has a ratio of 1 : 11 and in addition purchased 47 per cent. of the pigs fattened, relatively low production figures were obtained. This farm reared only 8·3 pigs per sow, compared with the best farm 17·5 pigs per sow. Compared with farm E, which has a wider ratio of sows (1 : 14) and a smaller proportion of purchased pigs, farm J should have produced better returns than it did. The smaller number of pigs reared, combined with the fact that the purchased pigs of J failed to thrive satisfactorily—23 per cent. of them dying—probably accounts in part for the difference.

The table suggests also that the sow-cow ratio is a possible factor in the case of farms E, K, L previously mentioned, and influenced the relatively lower yield of L.

(*d*) *Type of Trade.*

The production of porkers and weaners is usually stated to result in a greater production of pig-flesh than the production of pigs of bacon weight, due to the greater economy of food consumption of the lighter-weight pigs. This general statement is open to question on the grounds that it does not make due allowance for the heavier sow overhead associated with the production of pigs of light weights. Theoretical considerations previously mentioned suggest that the latter factor at least compensates for the former. In practice the

type or combination of types of trade followed is governed largely by the necessity for effecting as close a correlation as possible of feed requirements, types, and numbers of pigs with fluctuating seasonal milk-supplies, and by the additional factor of price of weaners in relation to the price of pork and bacon.

Table 4 sets out the relative production of bacon, pork, and weaners and stores of each farm.

Table 4.—Relationship between the Type of Trade practised and the Production of Pig-flesh per 100 lb. Butterfat.

Farm Letter.	Type of Trade as Percentage of Total Production of Pig-flesh.			Pig-flesh per 100 lb. Butterfat.
	Bacon.	Pork.	Weaners and Stores.	
				lb.
H	41	35	24	48·0
I	..	88	22	45·5
C	32	27	41	43·8
E	58	34	8	43·5
K	46	40	14	40·6
L	87	13	..	40·1
D	27	50	23	38·3
A	..	100	..	36·8
J	13	87	..	28·3
G	60	30	10	22·0

As far as the figures go, there seems no obvious relationship between the type of trade and the pig-flesh to 100 lb. fat index. It is interesting to note, however, that, with the exception of one farm, all have practised a mixed type of trade, combining at least two and in most cases all three methods. Averaging the figures of all farms producing above and those producing below 40 lb. pig-flesh per 100 lb. butterfat shows that, contrary to the popular conception, the greatest returns have been obtained where bacon trade has predominated and the lowest where pork production played the most important part. The comparison is made on too few farms to be significant, however, and is complicated by the evidence that the lower producing farms have not utilized their skim-milk to the best advantage.

(e) *Purchased Supplementary Foods used.*

Table 3 (column 6) shows the amounts of purchased meals used on the respective farms per 100 lb. of pig-flesh produced. It is noteworthy that good returns have been obtained on these farms with but little assistance from purchased meals, a fact of considerable importance to the pig industry in view of the price of meals for pig-fattening in dairying districts. It is noteworthy, too, that all of the best farms have used some meals, though the quantities employed were very small. Farm C has been by far the largest concentrate feeder, yet even here the amount has been relatively low, amounting to only 2 tons over a total production of 5,918 lb. of pig-flesh, or 67 lb. of meal per 100 lb. of pig-flesh. This farm carried the greatest proportion of sows to cows —1 : 5. Farms A and K are interesting in showing good results without the use of any purchased meals.

(f) *Size of Farm.*

On the number of farms available there seems no significant relationship between the size of the farm and the production of pig-flesh per 100 lb. butterfat (Table 2). Six most efficient farms, producing over 40 lb. per 100 lb. butterfat, ranged from 31 acres to 136 acres in area. The least efficient production was obtained from an area not substantially different from the area yielding the most efficient production. On a per-acre basis, too, there seems no correlation, the larger areas comparing favourably with the smaller.

Gross Cash Returns with Pig-flesh at varying Prices.

Tables 5A and 5B set out the gross cash returns of each farm on a butterfat and a per-cow basis respectively, valuing the pig-flesh produced at varying prices of 3d., 4d., and 5d. per pound. The figures show not only the revenue which it is possible to derive from pig-raising on the dairy-farm, but also the effect upon gross cash returns of different levels of production.

Table 5A.—Gross Cash Returns per Pound of Butterfat with Pig-flesh at varying Prices.

Farm Letter.	Pig-flesh per 100 lb Butterfat	Pig-flesh at 3d per Pound	Pig-flesh at 4d. per Pound.	Pig-flesh at 5d. per Pound.
	lb	d.	d.	d
H	48·0	1·44	1·92	2·40
I	45·5	1·36	1·82	2·28
C	43·8	1·32	1·75	2·19
E	43·5	1·31	1·74	2·18
K	40·6	1·22	1·62	2·03
L	40·1	1·20	1·60	2·01
D	38·3	1·15	1·53	1·92
A	36·8	1·10	1·47	1·84
J	28·3	0·85	1·13	1·42
F	27·7	0·83	1·11	1·39
G	22·0	0·66	0·88	1·10

On a butterfat basis the returns vary by considerable amounts—from 1·92d. per pound to 1·53d. per pound on the seven best farms, and from 1·47d. to 0·88d. per pound on the four worst farms, with pig-flesh at 4d. per pound. The gross returns per pound of butterfat of the three best farms are practically double those of the three worst.

Table 5B.—Gross Cash Returns per Cow with Pig-flesh at varying Prices.

Farm Letter.	Pig-flesh per Cow.	Pig-flesh at 3d. per Pound.	Pig-flesh at 4d per Pound.	Pig-flesh at 5d. per Pound.
	lb.	£ s. d.	£ s d.	£ s d.
I	136·6	1 14 2	2 5 6	2 16 10
H	134·2	1 13 7	2 4 9	2 15 11
C	131·3	1 12 10	2 3 9	2 14 8½
L	113·7	1 8 5	1 17 11	2 7 4½
K	104·6	1 6 2	1 14 10½	2 3 7
E	97·2	1 4 3½	1 12 5	2 0 6
A	97·2	1 4 3½	1 12 5	2 0 6
D	87·2	1 1 9½	1 9 1	1 16 4
J	84·4	0 14 7	1 4 9½	1 11 0
G	58·3	0 14 7	0 19 5	1 4 3½
F	55·8	0 13 11½	0 18 7	1 3 3

Cash returns from pigs are often stated on a per-cow basis, though, as already stated, a butterfat basis is more informative. At 4d. per pound the gross cash returns per cow have varied from £2 5s. 6d. to £1 14s. 10d. on the farms yielding over 100 lb. of pig-flesh per cow and from £1 12s. 5d. to only 18s. 7d. where the yield has been less than 100 lb. of pig-flesh per cow.

Cash Returns over Meal Costs.

If the cash outlay involved in the purchase of meals to supplement skim-milk be deducted from gross cash returns, the figures obtained will more closely represent the net value of the by-products used. Table 6 shows the net cash returns over meal costs on the different farms, based on meals at a flat rate of £9 per ton and pig-flesh at 4d. per pound.

Table 6.—Cash Returns over Meal Costs with Pig-flesh at 4d. per Pound and Meals at £9 per Ton.

Farm Letter.	Gross Cash Returns.			Cash Returns over Meal Costs. Total			Per Cow.			Per Pound of Butterfat.
	£	s	d	£	s.	d.	£	s.	d	d.
H	116	16	8	114	14	8	2	4	1½	1·9
I	45	0	8	43	16	7	2	3	10	1·75
E	137	15	4	134	3	4	1	11	5	1·69
K	54	1	8	54	1	8	1	14	10½	1·62
L	113	14	0	105	12	9	1	15	2	1·49
C	98	12	8	82	13	2	1	16	8	1·47
A	61	11	4	61	11	4	1	12	5	1·47
D	39	5	9	35	11	0	1	6	4	1·38
J	39	13	4	39	13	4	1	4	9½	1·13
G	63	3	4	61	16	1	0	19	0	0·86

These figures show, first, that pigs have contributed considerable revenue on most farms, and, secondly, that this has been done at little meal cost. With the exception of farm C, which holds third place in gross returns (Table 5A), but only sixth place when meal costs are deducted (column 4 above) due to the heavier rate of supplementary feeding on this farm, the deduction of the cost of meals has made little difference to the cash-return figures. It must be noted, too, that, while meals have been charged at a flat rate of £9 per ton, the actual cost was in most cases lower than this.

The figures of column 4, representing the cash returns per pound of butterfat are significant, and indicate that under good management the utilization of by-products by pigs can make a substantial contribution toward the farm dairy returns. Seven farms show a return of from 1½d. to 2d. per pound of butterfat. If the average price of butterfat for the 1932–33 season be placed at 10d., 2d. per pound of butterfat from raising pigs represents a 20-per-cent. increase on butterfat returns over the farm which makes no use of dairy by-products. The argument can be carried even further. Most will agree that the cost of butterfat-production is at least 8d. per pound. The greater part of the returns from pig-fattening on separated milk represents profit. Where the farmer is receiving, say, 9d. per pound for butterfat—a price

probably greater than will be received during the present season—and is producing ½ lb. of pig-flesh per pound of butterfat, he is making a greater net return from his separated milk than he is from his butterfat.

SUMMARY.

(1) Figures are presented showing the position of pig-raising in relation to dairying on eleven Manawatu dairy-farms during the 1932–33 dairying season. The figures can be considered to represent the best of sixty farms.

(2) The production of "pig-flesh pei 100 lb. of butterfat" is suggested as the best single index available for comparing relative efficiencies of pig management as a means of utilizing dairy by-products on the dairy-farm.

(3) The most efficient farm shows a return of over 48 lb. of pig-flesh per 100 lb. of butterfat, but it is suggested that it is quite practicable to obtain at least 40 lb. of pig-flesh per 100 lb. of butterfat on the average on the home-separation dairy-farm.

(4) The production of pig-flesh on the dairy-farm can be increased by the use of meals, but the economy of such practice is dependent upon relative costs.

(5) Relationships between the production of pig-flesh and the production of butterfat indicate—

(*a*) Increase in the production of butterfat per acre should be accompanied by increase in pig production:

(*b*) Increase in the production of butterfat per cow should be accompanied by increase in pig production:

(*c*) Land improvement, cow improvement, and pig improvement should go hand in hand.

(6) It is quite practicable for the Dominion to expand the export of pig-flesh even if pig prices are low, for pigs, properly managed, utilize the dairy by-products which otherwise go to waste.

(7) The results presented show dairy-farmers can materially restrain the effects of falling prices for butterfat by the careful breeding, feeding, and management of pigs. Under the low prices for dairy produce now operating, separated milk efficiently utilized will yield a greater net return to the farmer than will butterfat.

In conclusion the writer would like to take this opportunity of thanking all those farmers who co-operated with the Manawatu-Oroua Pig Recording and Development Club in supplying the information for this analysis. In particular, thanks are due to Mr. W. J. Croucher, Pig Recording Officer, who was responsible for the collection of the data on the farms.

Compensation paid for Stock and Meat condemned.—Compensation to the amount of £6,780 was paid out during the year ended 31st March last for animals condemned in the field for disease under the provisions of the Stock Act, and £10,581 for carcasses, or parts of carcasses, condemned for disease on examination at the time of slaughter at abattoirs, meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

THE METHOD OF PREPARING AND PACKING APPLES AND PEARS FOR EXPORT.

A. T. DOUGLAS, Orchard Instructor, Nelson *

IT is desired to impress on all exporters of apples and pears the desirability and necessity of having their fruit handled with every possible care from the time picking operations commence until the fruit is outside their control.

CARE IN PICKING.

Commencing with the operation of picking, one of the first things a picker should look to both at the start and during the day's work is the cleanliness of the picking bag, apron, or receptacle in use, as the collection of dirt and small twigs in the bag is liable to puncture and scratch the fruit. Fruit that is accidentally dropped on to the ground should be left there and not picked up and put into the picking-bag. The actual operation of picking is quite simple if adequate care is taken. The fruit should be picked so that the stem is intact and still adhering to the apple. This can usually be accomplished by taking the fruit in the palm of the hand, and by lifting the fruit upwards it will usually come away from the tree quite easily. If the fruit is pulled off there is always the possibility of breaking the skin or fracturing the tissues at the base of the stalk. Rots very frequently develop as a result of these injuries.

After the fruit is picked it should be placed gently into the bag or apron, which should not be filled too full. It is much better to empty the picking bag or apron into the orchard case frequently than to wait until it is overflowing before emptying. When emptying the picking-apron into the orchard case exercise as much care as possible, as bruising may take place if the fruit is emptied out roughly. Lower the apron down into the case before releasing the fruit and break the fall with the hands as much as possible. Do not stand almost upright and release the fruit with a rush ; but bend the body to the desired extent to permit the fruit to roll gently into the case.

The orchard cases should not be overfilled, especially if a double tier is being carried on the conveyance to the packing-shed. The fruit in the cases should be levelled off to prevent the second tier from riding on the fruit beneath. The extra care and time taken to see that no fruit is projecting above the top of the cases would avoid damage to the fruit from this cause. The use of a cover or tarpaulin over the load also helps to keep the fruit firm, especially if the ground traversed is at all bumpy.

PRECAUTIONS IN PACKING.

On delivery to the packing-shed, the fruit passes into the hands of the graders, whose duty it is to sort out the fruit into the respective grades according to the standard requirements laid down, and place the fruits on the belt or conveyers which carry them to their respective bins in readiness for packing. Simultaneously, fruit which is below

* Substance of a lecturette broadcast from Station 2YA.

the required standards must be eliminated as rejects. The usual practice followed in grading is to tip the fruit from the orchard cases on to the grading-table. The table should not be overloaded, for such a practice may cause bruising and stem puncture. The correct method is to have a gradual supply of fruit going on to the grading-belts, as this obviates the necessity for the persons grading to hold the belts stationary until the bulk of the fruit on an overloaded table is disposed of.

As practically the whole of the pip fruits which are exported from the Dominion are passed for sizing purposes over mechanical graders of various types, a word of advice to growers at this stage concerning the cleanliness of their grading-machines would not be out of place. The grading-machine should be put in thorough mechanical working-order prior to the commencement of the season. It should be stripped and thoroughly scrubbed and cleaned during the off season, as much damage can be done by dirty rollers or belts, especially to the tender-skinned varieties of fruits in the early part of the season when much scratching of the skin can occur from this cause. During the season a periodical wipe-down of rollers, belts, and bins to remove dirt particles also helps considerably.

One of the main causes of fruit being damaged by stem punctures is the practice of packers pulling the fruit down in the bins and allowing bins to become too full. The damage is caused during the pulling-down process—that is, scooping the fruit which is dropping from the fruit-conveyers forward towards the front of the bin, the stem of one fruit punctures the skin of another fruit, and the injury can easily pass unnoticed during the process of packing, but has a disastrous effect on the fruit and is the cause of considerable waste.

The process of packing fruit is an art unto itself. When the packer commences work the fruit has already passed over the grader, and has been graded according to standard requirements, and has also been sized as nearly correctly as a mechanical grader can be expected to size fruits of various shapes. As very few of the mechanical graders size accurately, a good deal of responsibility rests with the packer to place wrongly sized fruits in their proper bins, and to throw out any undergrade or reject fruits which have inadvertently been missed by the persons who are grading. A packer will on an average pack neatly from eighty to one hundred cases per day.

Three grades are set down in the standard requirements for export in the coloured varieties of apples—namely, Extra Fancy, Fancy, and Good grades—and two in the yellow or green varieties—namely, Extra Fancy and Fancy, each variety and grade with varying allowances of colour, russet, blemish, &c. These grades may be packed according to size into approximately as many as fifteen separate counts..

In the past the sizes allowed for export have varied from 3½ in. fruit down to 2⅝ in. fruit. The Canadian standard case with an inside measurement of 10½ in. by 11½ in. by 18 in. is the only type of case used for apples. The pack used is known as the diagonal pocket pack. In this pack three distinct styles are used—namely, the 2 by 2 pack, the 3 by 2 pack, and the 3 by 3 pack. In this way each apple, if properly placed, rests in a pocket between two apples in the layer below, hence the name "pocket pack." No fruit should be so placed as to cause it to rest directly on top of another

fruit in any direction. By this method the fruit is kept firm and is prevented from moving about in the case during handling in transit, with the result that little bruising should occur.

The 2 by 2 pack is used for large-sized fruit up to 3¼ in. in diameter, the 3 by 2 is for medium-sized fruit from 3 in. in diameter to 2⅝ in. in diameter, and the 3 by 3 pack is for fruit 2½ in. to 2⅛ in. in diameter.

To obtain a well-packed case of fruit with the requisite amount of bulge on the top and bottom of the case, to ensure a full and firm pack, and to obtain what is known as a "crown pack," the following routine should be adopted by packers: The fruit must first be properly wrapped; this means that the whole of the fruit must be covered by the paper wrapper; each individual fruit must be placed in its proper position with the stalks of the fruit facing to one end of the case, as this obviates stem punctures; each fruit must be placed in the case either with the calyx or with the stalk end of the fruit square on to the end of the case. On no account should the fruits be placed on an angle, as this makes the fruit in the layer too tight and allows no pocket for the fruit in the tier above to rest in; it also makes the pack too solid, and will not allow the fruit to give and fit snugly into the pockets. Extensive bruising is caused by angling the fruit, and in most cases it causes the pack to be too high, thereby causing bruising when the lid is brought into position for nailing down.

During packing each alternate layer should receive a slight pressure from the hands of the packer at the two ends of the layer only. On no account should pressure be exerted on the centre of the layer. By applying this pressure on the two ends of the layers a crown is formed, and when the case leaves the packer's hands the fruit at the end of the layers should be no more than ½ in. above the top of the case, while the fruit at the centre should be about 1½ in. higher than the case.

Some variation is noticeable in the tightness of the various types of packs used, and a good deal of discretion on the part of the packer must be used to ensure that no bruising will take place through faulty packing. It is noticeable that in the case of the tighter packs such as 96, 163, 175, and 252, some packers do not use enough discretion, and make the bulge in these packs as high as in the packs with more open pockets. This should not be so, as these packs being more compact and with smaller pockets should be ½ in. lower both at the ends and centres of the case as compared with the looser packs.

In the majority of packing-sheds to-day, lidding is done by means of a press worked by exerting pressure on a foot lever after the case has been placed in position, causing two horizontal arms to swing in a forward and downward motion, and thereby holding the lid in position for the nailing of the cleats and lid on to the case. The person responsible for this operation should exercise every care to see that there is no danger of fruit at the ends or sides of the case being cut during the actual operation of applying pressure to the lid. It is also advisable for the person who is actually doing

the job to place both hands and exert his weight downwards on the centre of the lid at the same time as the pressure is being applied to the lid by the arms of the lidding press.

In conclusion, although attention has been directed to a number of faults which occur in the packing of fruit, with a view to bringing about a further improvement in regard to more careful handling, it is only right to state that a large number of growers and packers put up their fruit in a careful and attractive manner. In some instances, however, sufficient care is not taken, and this helps to spoil the reputation of all our growers, and for that reason all should try to handle their fruit with the greatest care and endeavour to maintain a high standard for New Zealand fruit on the markets overseas.

POTATO-MANURING EXPERIMENTS.

INVESTIGATIONS INTO THE EFFECT OF WIDTH OF PLOTS ON YIELD DETERMINATION.

A. W HUDSON, Crop Experimentalist, Plant Research Station, Palmerston North ; and E M. BATES, Instructor in Agriculture, Fields Division, Department of Agriculture, Ashburton

PRIOR to the 1930–31 season about sixty potato-manuring experiments conducted by the Department of Agriculture during the preceding six years consisted of frequently replicated plots each three rows in width. It is a well-established principle that, for a given area under experiment, the use of small plots frequently replicated will result in a more accurate determination of yield and smaller associated errors than if the same area is covered by larger plots less frequently replicated. It is assumed, of course, that plots would not be reduced in size to an extent which would cause competition between plots, &c., to introduce errors which would invalidate the results from each individual plot. Alternatively, the same degree of precision in the measurement of yields and differences may be obtained from a smaller total area of relatively smaller and more frequently replicated plots as from some greater area in larger and less frequently replicated ones. By adopting a suitable arrangement of the former a reduction is possible in the field-work and expense entailed, because of the less amount of crop to be handled, without loss of precision.

The experiments described below were carried out with the object of determining whether or not the adoption of single-row plots, which would materially reduce the work involved compared with large plots, would result in unduly large real errors. At the same time, it was possible to get some idea of the errors introduced by assessing yields from all rows as opposed to using the middle rows only, in three-row plots.

DESCRIPTION OF EXPERIMENTS AND TECHNIQUE.

The 1929–30 and 1930–31 trials were conducted on the property of Mr. W. J. Crozier, and in 1931–32 on Mr. W. A. McPhail's, both at Mitcham, Mid-Canterbury.

The soil probably falls in the fine sandy silt or fine sandy loam class, being very friable and overlying shingle at a depth of a few feet. It is representative of a good deal of the lighter potato-growing soils of Canterbury.

The rainfall averages about 25 in. per annum. Dry conditions were experienced during the growing period of the crops, especially in 1930–31 and 1931–32.

The treatments under trial were as follows in hundredweights per acre :—

		Cwt.
O	= no manure	
P	= superphosphate (20·2 per cent. P_2O_5)	3
PN	= super 3 cwt., sulphate of ammonia 1 cwt	4
PNK	= super 3 cwt., sulphate of ammonia 1 cwt., sulphate of potash 1 cwt.	5
PK	= super 3 cwt., sulphate of potash 1 cwt.	4

For convenience the treatments will be referred to as O, P, PN, PNK, PK.

Each plot was three rows in width (rows 30 in. apart) in each experiment. In the 1929–30 experiment each plot was 2 chains and in 1930–31 and 1931–32 1 chain in length.

There were ten replications of each treatment in the 1929–30 experiment, the order being as under :—

Five replications.	Five replications.
&c , PK, PNK, PN, P, O.	O, P, PN, PNK, PK, &c

In 1930–31 and 1931–32 each experiment was laid down in two series, there being twenty replications of each treatment as under :—

Five replications.	Five replications.
&c., O, P, PN, PNK, PK	PK, PNK PN, P, O, &c.
&c , PK, PNK, PN, P, O	O, P, PN, PNK, PK, &c.

The above arrangement was adopted with the object of reducing the influence of any fertility slope which might be present.

Fertilizers were applied by hand along the line in the bottom of the furrow occupied by the potato sets. In order to ensure as uniform a distribution as is possible by hand, the fertilizer for each row was weighed out separately and applied in the first instance as uniformly as possible, but at a rate below that necessary. The balance was then spread evenly over the quantity already applied.

Digging was done by hand, each row being divided into ½-chain lengths for convenience of handling, and weighed to the nearest $\frac{1}{10}$ lb. Sorting into table, seed, and small grades was done in the process of picking up the potatoes, standards being agreed on beforehand. Care was taken to avoid individual bias which might result if one individual picked up one particular plot-row or treatment and another individual some other, throughout the trial.

" Student's " method of comparing paired plots was used in computing the statistical significance of the results presented in Tables 1 and 2.

Table 1.—Effects of Manures estimated from Yields (a) of Middle Rows only, (b) of all Three Rows, in Hundredweights per Acre and Yields of No Manure (O)

Estimated from	1929–30 Season.				1930–31 Season.				1931–32 Season.				Average of Three Seasons.			
	Table	Seed.	Small.	Total.	Table.	Seed.	Small	Total.	Table.	Seed.	Small.	Total.	Table	Seed.	Small.	Total.
Effect of P—																
Differences of P from O (a) Middle rows	5·8	**5·3**	**7·2**	**18·3**	**−5·1**	**6·9**	**8·4**	**10·2**	**11·5**	**10·4**	**5·2**	**27·1**	4·1	7·5	6·9	18·5
Differences of P from O (b) All three rows	**9·4**	**5·9**	**6·2**	**21·5**	−1·1	**5·6**	**8·9**	**13·4**	**15·1**	**11·3**	**6·1**	**32·5**	7·8	7·6	7·1	22·5
Effect of N—																
Differences of PN from P (a) Middle rows	**29·4**	**10·3**	**6·8**	**46·5**	−0·8	**4·4**	**10·8**	**14·4**	**7·9**	2·8	**5·8**	**16·5**	12·2	5·8	7·8	25·8
Differences of PN from P (b) All three rows	**25·5**	**9·1**	**7·1**	**41·7**	**−3·4**	**5·0**	**11·6**	**13·2**	**8·4**	1·0	**5·1**	**14·5**	10·2	5·0	7·9	23·1
Differences of PNK from PK (a) Middle rows	**38·0**	**6·2**	**5·7**	**49·9**	−0·9	**6·7**	**12·8**	**18·6**	**12·0**	2·7	3·1	**17·8**	16·4	5·2	7·2	28·8
Differences of PNK from PK (b) All three rows	**34·5**	**6·9**	**6·3**	**47·7**	−0·7	**7·7**	**13·4**	**20·4**	**11·2**	1·8	**2·8**	**15·8**	15·0	5·5	7·5	28·0
Effect of K—																
Differences of PK from P (a) Middle rows	0·3	1·9	0·3	2·5	**8·6**	−1·6	−2·6	4·4	2·8	−0·4	0·7	3·1	3·9	0·0	−0·5	3·3
Differences of PK from P (b) All three rows	−0·8	2·3	0·5	2·0	**6·4**	−1·1	−2·9	2·4	0·6	−1·0	0·5	0·1	2·1	0·1	−0·6	1·5
Differences of PNK from PN (a) Middle rows	**8·9**	**−2·3**	−0·7	**5·9**	**8·5**	0·7	−0·6	**8·6**	**6·8**	−0·5	−2·0	4·3	8·1	−0·7	−1·1	6·3
Differences of PNK from PN (b) All three rows	**8·1**	0·2	−0·3	**8·0**	**9·1**	1·5	−1·1	**9·5**	3·4	−0·3	−1·8	1·3	6·9	0·5	−1·1	6·3
Yields of O (a) Middle rows	69·0	33·0	15·7	117·7	50·9	35·9	29·4	116·2	62·7	20·9	10·5	94·1	60·9	29·9	18·5	109·3
Yields of O (b) All three rows	68·6	33·0	16·6	118·2	49·2	36·2	29·6	115·0	60·9	21·2	10·1	92·2	59·6	30·1	18·8	108·5

Table 2.—Comparison of Yields from Side Rows with those from Middle Rows of Three-row Plots of each Treatment.

Treatment.	Comparison.	Hundredweights per Acre															
		1929–30.				1930–31.				1931–32.				Average of Three Seasons.			
		Table	Seed.	Small	Total.	Table	Seed	Small	Total	Table	Seed.	Small	Total.	Table	Seed.	Small.	Total.
	Difference of side row next to—																
O (having P plots on one side and PK on the other)	P from middle row	−2·7	0·6	2·2	0·1	−1·0	0·7	0·1	−3·2	−2·1	0·4	−1·0	−2·7	−2·9	0·6	0·4	−1·9
	PK from middle row	0·6	0·9	0·4	1·9	−2·1	0·3	0·2	−1·6	−3·9	0·5	−0·2	−3·6	−1·8	0·6	0·1	−1·1
P (having O plots on one side and PN on the other)	O from middle row	**7·6**	2·0	−1·5	**8·1**	**4·7**	−0·7	1·5	**5·5**	**6·1**	1·7	0·4	**8·2**	6·1	1·0	0·1	7·2
	PN from middle row	2·1	−0·3	1·1	2·9	2·3	−2·2	0·4	0·5	−0·9	1·9	1·1	2·1	1·2	−0·2	0·9	1·8
PN (having P plots on one side and PKN on the other)	P from middle row	−1·8	0·4	1·7	0·3	−0·1	0·3	2·4	**2·6**	4·5	−1·8	−0·3	2·4	0·9	−0·4	1·3	1·8
	PNK from middle row	0·1	−2·5	−1·2	−3·6	−0·6	−1·2	1·9	0·1	1·9	0·0	−0·1	1·5	0·5	−1·2	0·1	−0·6
PNK (having PN plots on one side and PK on the other)	PN from middle row	−3·7	2·7	1·8	0·8	0·0	−0·2	3·2	**3·0**	−4·2	1·0	0·7	−2·5	−2·6	1·2	1·9	0·5
	PK from middle row	−0·2	2·7	0·0	2·5	1·2	1·9	−0·3	2·8	0·4	−2·0	−0·8	−2·4	0·5	0·9	−0·4	1·0
PK (having O plots on one side and PNK on the other)	O from middle row	**7·5**	1·8	−0·8	**8·5**	0·4	0·1	2·3	2·8	0·9	−0·3	0·9	1·5	2·9	0·5	0·8	4·2
	PNK from middle row	1·1	1·0	−0·2	1·9	0·2	−2·2	−0·1	−2·1	−1·6	1·9	0·1	0·4	−0·1	0·2	−0·1	0·0

Figures in heavy type represent statistically significant differences: Odds greater than 30 to 1.

Discussion of Table 1.

In Table 1 the effects of the various fertilizers on the yields of the various grades are estimated from (*a*) middle rows only, (*b*) all three rows. (The actual yields of the no-manure treatments are shown at the foot of the table.)

On the assumption that the yields of the middle rows are not influenced to an appreciable extent by competition between plots of different treatments, the comparison between the effects of the fertilizers estimated from the yields of the middle rows on the one hand and from all three rows on the other provides a measure of the errors introduced by the latter method of estimation.

Effect of P.—Estimating the yields from all three rows has resulted in an overestimate of the effect of superphosphate on the yield of table grade potatoes in all three experiments. The yields of seed and small grades are very similar under both systems of estimation. (The reason for the overestimate is made apparent in Table 2.) As a result, the error in estimation of total yield is about the same as that of yields of the table grade.

Effect of N.—It is only in the 1929–30 season that a marked discrepancy occurs, between the two systems of determining the differences in yield so far as the treatments receiving nitrogen are concerned. It will be seen from Table 2 that this is due not so much to differences between the middle and side rows of the nitrogen-treated plots as to errors associated with the estimate of yields from all three rows of the P and PK plots from which the differences of PN and PNK respectively are estimated.

In relation to the actual increases in yield the discrepancy is not a great one, however

Effect of K.—There is reasonable agreement, on the average, between effects of K estimated from middle rows only or from all three rows, the biggest difference occurring in the third season.

Discussion of Table 2.

The comparison of side rows of the three-row plots with middle rows provides a measure of how errors in yields estimated from all three rows have arisen.

Treatment O.—Both side rows of O (next to P on one side and PK on the other) have, with one exception, slightly lower yields of table grade than the middle row, although none of the differences is statistically significant. It is certain, therefore, that the side rows have not derived any benefit from the adjoining manured rows of the P and PK plots. On the contrary, they appear to have suffered to a small extent from the competition of the more vigorous growth of the P and PK plots. To what extent root competition occurred was not determined, but the growth of tops was invariably more vigorous on all the manured plots than on those not receiving manure.

Treatment P.—Comparison of side row next to O with the middle row of this treatment (P) shows that the former is significantly better in yield of table potatoes and in total yield in each of the three seasons. Obviously this is due to the less vigorous growth of the plants on the adjoining O treatment.

To what extent the lesser growth of the tops of the plants on the O treatment, allowing more light to and better development of the tops of the outside row of P treatment, and to what extent less root competition from the O treatment may have been responsible for the differences recorded, it is impossible to say.

All fertilizer treatments increased the growth of the tops, and, broadly speaking, the treatments including nitrogen (PN and PNK) were very nearly as much superior to P and PK in their effect on the growth of tops as P and PK were superior to O. If, then, the greater yield of the side row of P next to O was due solely to a better development of the tops, a somewhat similar result from the side rows of PN next to P and of PNK next to PK should have occurred. Table 2 and the graph indicate that on the average of all seasons this did not occur appreciably in either case. It seems justifiable to conclude therefore that the side rows of P next to O benefited primarily because they were subjected to less root competition than the middle rows and the side rows next to PN, each of the latter being in competition on both their sides with rows receiving the same amounts of superphosphate as they received themselves.

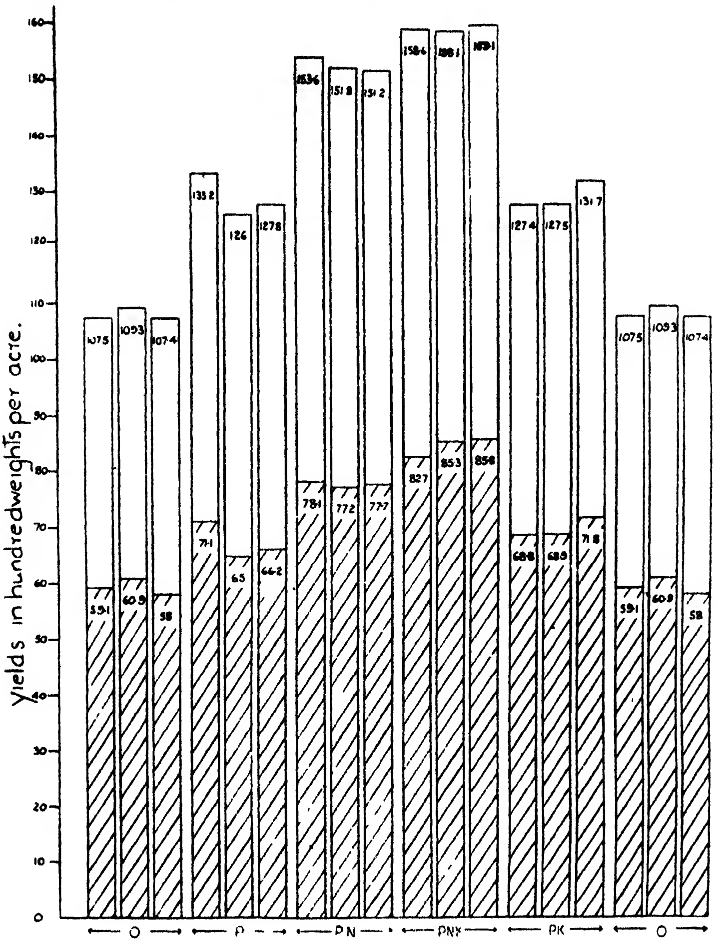
There are no significant differences between the middle rows and the side rows of P next to PN.

Treatments PN and PNK.—The only statistically significant differences between middle- and side-row yields occurred in the 1930–31 season, when the total yields of each of the PN and PNK treatments were affected, the small grade of potatoes contributing almost entirely to the differences in the total yields. On the average of the three seasons the differences between middle row and side rows were small.

As mentioned above, PN and PNK treatments increased the growth of tops very appreciably over P and PK, the former being only slightly different from one another in appearance. In the 1929–30 season PN appeared slightly bigger in top growth than PNK, the reverse applying in 1930–31 and 1931–32.

Treatment PK.—In the 1929–30 season the side row of PK next to O behaved, relative to its middle row, in almost exactly the same way as the corresponding rows of P. Subsequently, however, differences were small and not significant.

The different behaviour of this treatment from that receiving P only in the 1930–31 and 1931–32 seasons is of interest, as it would seem logical, in view of the very slight differences in their appearances, to expect their individual rows to behave similarly. The following is suggested as a possible explanation of their not doing so. In 1930–31 the growth of tops on the PK treatment was, about ten weeks after planting, slightly inferior to that on P. (This retarding effect of potash on early growth has been observed in other experiments.) This retardation of top growth would undoubtedly be accompanied by a retarding of root growth, and it is possible that the extra development of the root system which it is suggested occurred on the side row of P next to O did not occur, to the same extent at any rate, in the corresponding row of PK. It should be noted, however, that no retardation due to potash was noticed in the 1931–32 season, whereas, if anything, potash improved top growth a little. No differences between P and PK plots were observable in 1929–30.



Graph showing yields of individual rows (averages of three experiments). The diagonally-shaded portions represent yields of *table* potatoes Full columns represent total yields See discussion on Table 2.

Summary and Conclusions.

Three experiments on the manuring of potatoes, in which O, P, PN, PNK, and PK treatments were replicated from ten to twenty times in three-row plots, are described. Each row was weighed separately with the object of determining the effects of competition between outside rows of adjoining treatments and the differences in yield between middle and side rows of each treatment.

The soil under trial responded to applications of superphosphate and sulphate of ammonia and to a lesser extent to sulphate of potash, but, in the case of the latter, more particularly when used in conjunction with P and N.

The object of the investigation was to determine whether or not the adoption of single-row plots, which would materially reduce the work involved compared with larger plots, would result in unduly large

real errors. At the same time, it was possible to get some idea of the errors introduced by assessing yields from all rows as opposed to using the middle rows only in three-row plots.

The following tentative conclusions are drawn :—

(1) Side rows of no-manure plots alongside rows receiving P or PK did not differ significantly from the middle row or derive any benefit from the manure on the adjoining rows.

(2) Side rows of P plots next to O gave significantly greater yields than their middle rows. Side rows of P plots next to PN did not differ significantly from their middle rows. Estimating yields from P treatment situated alongside O from all rows in three-row plots resulted in an overestimation of the effect of the phosphate. Single-row plots would result in a greater overestimate.

(3) Side rows of PN plots alongside P on one side and PNK on the other did not differ appreciably from their middle rows, with one minor exception.

(4) Side rows of PNK plots alongside PN on one side and PK on the other did not differ appreciably from their middle rows, with one minor exception.

(5) Side rows of PK plots alongside O differed from the middle row in one experiment, but not appreciably in the other two. Side rows of PK plots next to PNK did not differ from their middle rows to any appreciable extent.

(6) From the fact that the treatments receiving nitrogen were approximately as superior in top growth to P and PK as P and PK were to O, it is suggested that rows of P next to O were at an advantage compared with other rows of this treatment, primarily because of less root competition. The failure of side rows of PK next to O, which were very similar in appearance to corresponding rows of P, to conform in all seasons to the behaviour of P is discussed.

(7) The results indicate that single-row plots for the comparison of treatments all of which receive a basal dressing of phosphate should be reasonably satisfactory, but that where phosphate is being tried against no manure on a soil responsive to phosphate, plots should contain at least three rows, and the outside rows should be disregarded in yield determinations. It must be recognized that the effect of potash was slight in these trials, and that, given a soil more responsive to this fertilizer, the behaviour of side rows relative to middle ones may have been different.

(8) Although these results indicate that assessing yield from all rows of three-row plots, as was done in the general programme of experiment up to the 1930–31 season, results in an overestimate of the effect of superphosphate when plots with this fertilizer are placed alongside no-manure plots, it is considered that such errors as have occurred are of no consequence for the following reasons :—

(*a*) The average increase due to superphosphate at 3 cwt. per acre in thirty-six experiments in which the super was alongside no manure was 18 cwt. of table potatoes and 5 cwt. of seed.

(*b*) Since 3 cwt. of super costs about 15s. and it requires only 5 cwt. of table potatoes at 3s. per hundredweight to meet the cost of fertilizer, there is still a big margin for profit even allowing for larger errors than were shown to occur in the experiments discussed in this article.

The thanks of the Department are extended to Messrs. Crozier and McPhail for their valuable assistance in the conduct of these trials.

PASTURE TOP-DRESSING IN OTAGO AND SOUTHLAND.

EXPERIMENTAL WORK BY THE FIELDS DIVISION.

R. B. TENNENT, Fields Superintendent, Dunedin, and A. STUART, Instructor in Agriculture, Invercargill.

IN the spring of 1929, forty observational top-dressing experiments were laid down throughout Otago and Southland, and these were followed by thirty-five additional experiments of a slightly different layout in the following year. In each succeeding season further experiments have been laid down either to replace those discontinued from various causes or to extend the investigation, but it is proposed in this article to deal only with the above seventy-five which have now reached a stage where the various manurial effects can be gauged.

The original plots were laid down according to the accompanying plan (Fig. 1) :—

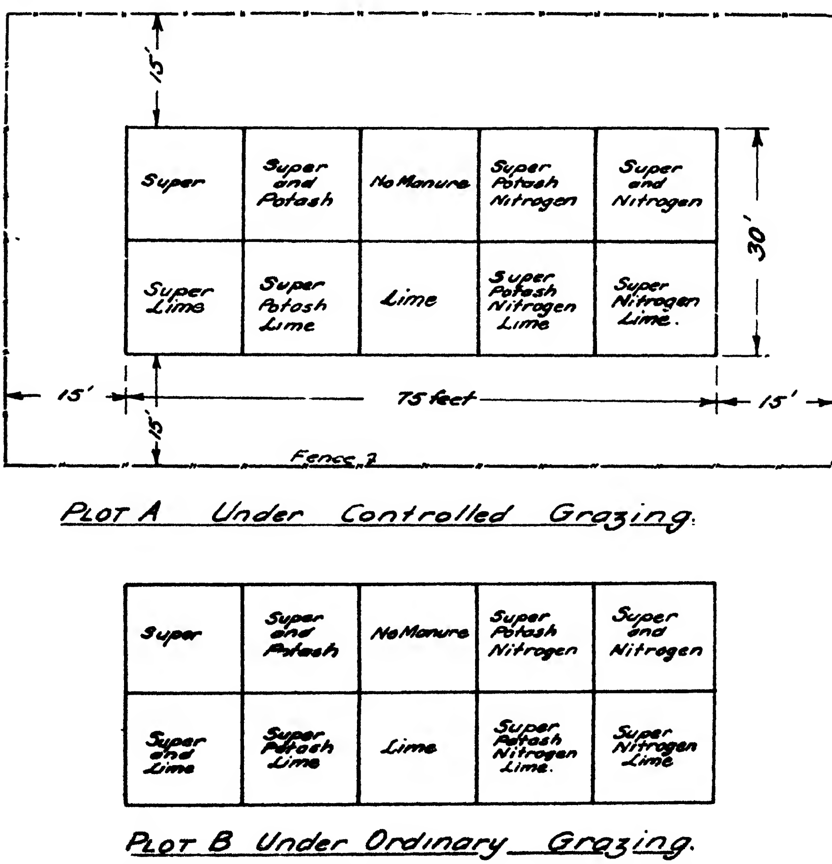


FIG. 1 PLAN OF GRASS OBSERVATIONAL PLOTS: DUPLICATE PLOTS LAID DOWN ADJACENT TO EACH OTHER.

NOTE.—Lime applied at the rate of one ton per acre.

The following season, owing to difficulty experienced by the co-operating farmer in the utilization of the controlled areas, stock were allowed free access to both areas, the fences being removed. In regard to the 1930 plots their layout was that as shown in Fig. 2.

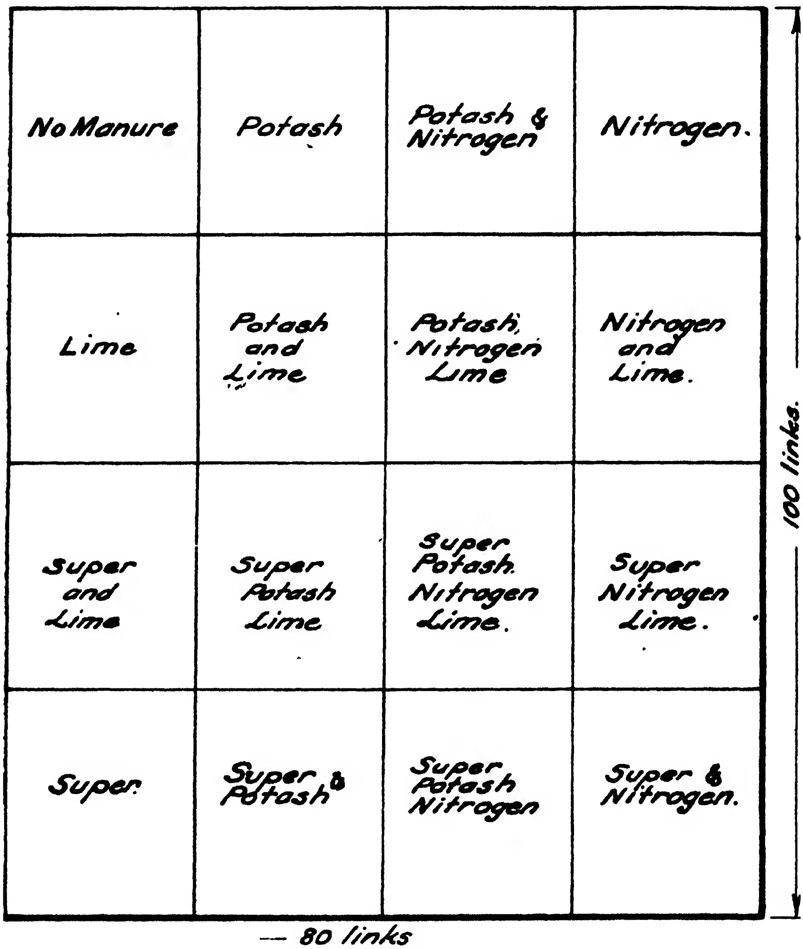


FIG. 2. PLAN OF PASTURE TOP-DRESSING EXPERIMENT (OBSERVATIONAL L.P.K.N. SERIES).

NOTE.—Lime applied at the rate of one ton per acre.

The treatments were applied to the plots in the autumn and spring at the following rates: (1) Carbonate of lime, 1 ton per acre (first year only); (2) superphosphate, 3 cwt. per acre; (3) potash salts (30 per cent.), 2 cwt. per acre; (4) sulphate of ammonia, 1 cwt. per acre.

In various localities, particularly in Southland, additional plots adjacent to the above series were treated with 3 cwt. per acre of basic slag. No further applications of lime were made until the autumn of 1932, when an additional 5 cwt. per acre was applied to those plots still being continued. Autumn applications of superphosphate and potash

salts, in most cases at the same rate as the initial applications, were made yearly. Sulphate of ammonia was applied twice per annum, generally during July–August and March–April.

SUMMARY OF RESULTS.

The results of each individual experiment are summarized in Table 1, which also groups the experiments according to the instructorate in which they were laid down. A key to the figures employed in pointing or indicating the effects is as follows: 0 = No visible response. ? = Doubtful response. 1 = Slight response. 2 = Fair response. 3 = Good response. 4 = Very good response. 5 = Excellent response.

Table 1 —Showing Responses to Lime and Manures on Individual Farms

Reference No. on Map and Farmer's Name and Address.	Lime.	Super.	Lime + Super.	Basic Slag.	Potash.	Nitrogen Spring.	Nitrogen Autumn.
CENTRAL OTAGO INSTRUCTORATE							
*1. R Gartly, Springvale	?	4	4	..	0	4	2
*2 J C Sanders, Little Valley	?	3	3	..	0	3	1
*3. J. Muir, Galloway	0	0	0	..	0	4	1
4. J D Williams, Hawea Flat	?	2	2	..	?	2	1
*5. T. Smith, Queensbury	0	2	2	..	0	4	1
6 D Roberts, Sutton	0	4	4	..	0	4	1
7. J E O'Connell, Frankton	?	1	1	..	?	2	1
8. T H Mee, Becks	?	3	3	..	0	2	1
9. A Grant, Lower Shotover	1	1	1	..	1	1	?
SOUTH OTAGO INSTRUCTORATE							
10. D McGregor, Milburn	0	3	3	..	0	3	2
11. I. M. Smollett, Awamangu	1	2	2	3	0	3	2
12. McCaw Bros., Forsyth	1	2	3	.	0	1	1
13. E Skinner, Waitahuna	1	2	3	..	0	2	1
14 A. J. Lunan, Murray's Flat	1	1	1	..	0	2	1
15. P. Bathgate, Allanton	?	2	2	..	0	2	2
16. G Donaldson, Highcliff	1	2	2	..	?	2	1
17. W Kirk, Mosgiel	0	2	2	..	0	2	2
18. Gunther Bros., Milton	2	0	2	..	0	1	1
19. T Bishop, Bishops	0	2	2	2	0	1	1
20. G. Stewart, Warepa	0	3	3	..	0	4	0
21. W. R. Gorman, Owaka	2	0	2	..	0	2	1
22. W. Stiven, Paretai	0	1	1	..	0	1	1
23. G. Muir, Upper Junction	1	2	2	..	0	1	1
24. J. D. Walker, Otokia	0	0	0	..	0	0	0
25. W. Bradfield, Tahatika..	1	2	3	..	0	3	2
26. J. B Morris, Owaka Valley	2	1	3	..	2	3	2
27. J. Christie and Sons, Warepa	1	2	3	..	0	3	1
NORTH OTAGO INSTRUCTORATE.							
28. G. Simpson, Kia Ora	0	1	1	..	0	2	0
29. J. Newlands, Ngapara	?	1	1	..	0	1	0
30. J. Hannan, Oamaru	0	1	1	..	0	1	0
31. W. McMillan, Herbert	1	1	2	..	0	2	0
32. J. Aitchison, Hillgrove	2	1	3	..	0	1	0
33. J. Grant, Awamoa	1	0	1	..	0	1	0
34. J. Rae, Kauru Hill	0	0	1	..	0	1	0
35. H. S. Sheat, Bushey	1	1	2	..	0	2	1
36. A. G. Mitchell, Kakanui	1	1	2	..	0	1	0
37. J. G. Williamson, Bortons	0	0	0	..	0	2	0
38. G. D. Hunter, Pukeuri	0	0	0	..	0	1	0
39. A. E. Austin, Five Forks	0	0	0	..	0	1	0
40. R. M. Williamsom, Five Forks	0	0	0	..	0	1	0

Table 1.—Showing Responses to Lime and Manures on Individual Farms—continued.

Reference No. on Map and Farmer's Name and Address.	Lime.	Super.	Lime + Super.	Basic Slag.	Potash.	Nitrogen Spring.	Nitrogen Autumn.
EASTERN SOUTHLAND INSTRUCTORATE.							
41. F. Kane, Glenkenich	1	2	3	..	0	2	1
42. J. F Herbert, Heriot	1	1	2	..	0	2	1
43. G. McBryde, Charlton	2	3	3	..	4	3	1
44. A R. Johnston, Waikaka Valley	2	2	3	..	0	3	1
45. S. Morrison, Waikaka Valley	3	1	4	..	0	3	2
46. D. Dun, East Chatton	2	2	3	..	0	2	1
47. H Smith, Waikaka Valley	1	2	3	..	2	4	2
48. R. Knibbs, McNab	3	2	4	..	2	2	2
49. A. Byars, Knapdale	1	3	4	..	2	3	1
50. E Smith, Edendale	1	2	4	4	4	2	1
51. G. Irwin, Mataura	2	2	3	..	2	3	2
52. R. K. Dodds, Charlton	3	2	4	..	1	3	2
53. J. Cowie, Balfour	1	2	2	..	1	2	1
54. E. W Stevens, Balfour	1	1	2	..	0	..	..
55. D McDonald, Balfour	3	3	4	..	4	3	2
56. W. Mortimer, Waipounamu	3	3	5	..	2	3	2
57. W. Fowler, Wendon	1	2	3	..	1	3	2
WESTERN SOUTHLAND INSTRUCTORATE.							
58. Evans Bros., Longbush	3	3	4	4	3	3	3
59. A. Horne, Morton Mains	3	3	4	3	3	4	3
60. W Barron, Morton Mains	0	3	3	3	0	3	3
61. A S McNaught, Rakahouka	0	3	3	3	4	3	3
62. G. McKay, Hedgehope	2	2	3	2	2	2	2
63. D McKenzie, Otapiri	0	3	3	4	3	3	2
64. W. G. Hartley, Ryal Bush	0	2	2	2	?	2	2
65. D McPherson, Waianiwa	0	3	3	2	4	3	3
66. R. Sim, Otahuti	0	2	2	2	2	2	2
67. C. Brown, Waimatuku	?	3	3	3	?	3	?
68. D. McRae and Sons, Dipton	2	3	3	3	4	4	3
69. A P. Lindsay, Waimatuku	3	3	3	4	0	3	?
70. C. Saunders, Woodlands	0	1	1	1	?	2	2
71. A. Robinson, Hedgehope	3	3	4	4	0	2	0
72. O. Neiderer, Gorge Road	0	3	3	2	?	3	0
73. R. E Monteath, Gorge Road	0	3	3	1	0	3	0
74. L. King, Rakahouka	0	3	3	2	0	3	0
75. A T Drain, Awarua Plains	2	2	3	2	?	2	0

COMMENTS ON TABLE I.

In Central Otago the best results have followed from the use of superphosphate, and also from the additional spring application of sulphate of ammonia. The experiments marked with an * denote those laid down on irrigated land, and it will be noted that Experiments 3 and 5, both of which were laid down on rye-grass (dominant) and white clover swards, have given very good results only to the spring applications of sulphate of ammonia. This result was obtained during the period in which irrigation was not practised. Poor results were experienced from Experiments 7 and 9, due to the poor quality of the pasture on these soil-types.

In South Otago the best results have been obtained from the application of lime plus superphosphate, closely followed by applications of

superphosphate alone. A spring application of sulphate of ammonia has been found beneficial. Very poor responses have resulted from the application of manures and lime on the Taieri Plain as exemplified in Experiments 15, 17, and 24. Very few of the remainder were originally laid down on first-class pasture or soil.

Exceptionally poor results have been obtained in the North Otago district, but it should be borne in mind that this district has experienced droughty conditions over the greater part of the period under review. Slight responses have marked the use of superphosphate and lime, and the spring application of sulphate of ammonia. Nevertheless, after allowing for the conditions experienced, it would appear that in this locality water becomes the limiting factor to pasture growth.

The best results in Eastern Southland have been obtained from lime and superphosphate both alone and in combination. The number of experiments which indicated a potash response is high, and it would appear that further investigations as to the value of potash would be warranted. Spring applications of sulphate of ammonia also gave beneficial results, while the responses obtained from the autumn application were superior to those obtained in other districts.

In Western Southland basic slag responses were practically on a par with those obtained from lime and superphosphate. Very good results were obtained from the application of potash, particularly in Experiments 61, 65, and 68. The lack of response to lime alone in quite a number of experiments probably is accounted for by the fact that sufficient lime had already been supplied in a district where the general farming practice is to sow down to grass with one ton of carbonate of lime.

It will be noticed that in Southland as a whole the response to both spring and autumn applications of sulphate of ammonia was much greater than in Otago, and this is probably due to the heavier rainfall conditions prevailing.

It is to be particularly noted that invariably the responses coincided with the class of pasture to which the fertilizers were applied. Browntop dominant pastures gave little or no response, whereas good mixed pastures of a dominant rye-white clover content invariably responded to treatment. The outcome of these observational experiments leads one to the conclusion that whilst phosphates predominate in importance as a top-dressing fertilizer, sulphate of ammonia and potash, particularly in Southland, give responses that fully merit further attention and investigation being devoted to the use of these two fertilizers. The ability of potash, particularly in conjunction with phosphate, to promote a denser sward in certain localities and the efficacy of sulphate of ammonia to invigorate early growth are features which must be commented upon.

Thanks are due to the various farmers co-operating in these trials, and acknowledgment has to be made of the painstaking and constant observations made by the various field officers throughout Otago and Southland.

In a Poverty Bay permanent pasture, which has wintered eight sheep an acre, the percentage of cover contributed by the various pasture species was : Perennial rye-grass, 67·5 ; white clover, 23·5 ; goose-grass, 6·8 ; burr clover, 1·2 ; various, 1.

SOME PARASITES OF OUR DOMESTIC LIVE-STOCK.

THEIR LIFE-HISTORIES AND DISEASE-PRODUCING CAPABILITIES.

C. S. M. HOPKIRK, Veterinary Laboratory, Department of Agriculture, Wallaceville, Wellington.*

THERE are a very large number of parasites to be found in and on our sheep, cows, horses, dogs, cats, poultry, &c., some comparatively harmless in themselves, but potential carriers of more serious diseases, and others, directly harmful, offering damage to the meat, hides, or even the life of their hosts. Children at school are taught the life-histories of flies and moths, the life-cycles of which are comparatively complicated and of general interest. Many of the animal parasites get into most unusual places in the animal body before finally becoming adult and their life-stories are even more interesting.

The chief kinds of parasites found externally are flies, lice, ticks, mange, fleas, and, within the body, flat worms or flukes, tapeworms, and roundworms.

" Swat that fly " sums up the general feeling of insecurity felt by all of us when we see the house-fly or the blow-fly on our food after parading on any available manure-heap, and the ubiquitous house-fly is a grave danger when we have disease epidemics to contend with. Important as is the common fly, there are other flies more dangerous as carriers of disease. Tropical countries possess carriers of sleeping sickness, malaria, and various other diseases of stock and man, but, fortunately, in New Zealand we have not the dangerous diseases of the tropics.

EXTERNAL PARASITES.

What farmer does not know the bot-fly of the horse. Two species are common here, and their life-cycles are similar. The eggs are commonly seen cemented to the hair of the legs or to the under lip. With saliva the eggs hatch out and the larva passes into the mouth, but, instead of going on down to the stomach, it burrows through the lining of the mouth and then on down the gullet as far as the stomach, where it again burrows out. In the stomach it grows until it becomes about an inch in length and remains in that position attached by a pair of hooks for nearly nine months. At the end of that time the larva lets go and passes out in the fæces, burrows into the ground, pupates, and later hatches out into the adult male or female fly. A little kerosene rubbed on the legs while the eggs are fresh will end this cycle at its commencement.

The nasal bot of sheep is now suspected of being implicated in that brain disease of sheep known as " circling disease." The fly lays its larvæ on the nostrils of sheep, and these larvæ travel into the sinuses of the head. There they live throughout the winter. It is thought that they irritate the sinuses and allow the entry of a germ which grows in the brain.

* Substance of a lecturette broadcast from Station 2YA.

Warble flies have a curious method of becoming adult. The egg is laid on the skin of the legs or over the shoulders of cattle. This process terrorizes cattle, and they gallop madly about to escape the fly. Later the developing larva burrows under the skin and about the body until it reaches a position below the skin of the back. When the larva is maturing a hole forms in a swelling to be seen on the back and finally the larva emerges, drops to the ground, where it pupates and becomes adult. This fly, therefore, spoils a great many hides in some countries, because it leaves a blemish in the leather where the larva emerges. Considerable controversy takes place from time to time in New Zealand over the possibility of this fly coming into New Zealand in cattle from Canada. Actually there is only the most slender chance, for these reasons: The season of emergence differs from that in Canada and the larva usually dies from exposure. No adult flies have ever been known to appear in New Zealand from larvæ from imported cattle. Larvæ are watched for in quarantine here and for a considerable time after the animals leave quarantine, each larva being squeezed out and destroyed in those animals found affected.

Flies of certain varieties may inadvertently cause cancer in horses. There is one fly which drops a live round worm larva on to the third eyelid of the horse. This larva burrows, and, finding itself in the eye, instead of in the stomach of the horse, it dies. The resultant irritation of the tissues sets up a form of cancer which will finally eat away the side of the face and eye, and the horse has to be destroyed.

Of the other external parasites, the cattle-tick is perhaps the most important, and yet, in spite of the fear it has created in the minds of the farming community, the species present in New Zealand is comparatively harmless. We have no blood diseases to be transmitted, and consequently the only damage done is to hides. In any case, the New Zealand species of tick will not transmit disease when given the chance. Eggs of the tick are laid on the ground in hundreds, the young larvæ hatch out and climb up grass-stalks, &c., and so on to stock, even birds such as sea-gulls being so visited. The larvæ, after a feed, drop off and become nymphs. These again climb on to cattle, gorge themselves on blood, and drop off to become adults, when the animal host is again visited for feeding purposes Lizards and birds, such as the kiwi, penguin, and sea-gull, carry various species of ticks other than the cattle-tick, but they, again, are quite harmless.

The mange parasite has recently come into some prominence in New Zealand in pigs. This minute form of animal life burrows into the skin and in the burrows lays eggs which there hatch and become adult parasites. Such skin parasites are easily overcome by oily dressings, and so, for control purposes, pigs are given a swim in crude oil to kill the parasite. We are fortunate that sheep scab, which is also due to a mange parasite, is not known in New Zealand. Further, dogs which may suffer are seen affected only extremely rarely in this country. Actually only three cases of true mange have come under my notice in ten years. This statement is made to counteract the many misstatements which one hears from time to time concerning mange in dogs of this country.

Most animals have their own species of flea, but a flea is only dangerous when it can transmit a blood disease from one affected

animal to a clean one. The worst of such diseases is bubonic plague, transmitted by a rat flea from the rat to man or from rat to rat. Rats are therefore barred from entering New Zealand from countries such as India, as they are distinctly undesirable immigrants.

Internal Parasites.

A representative of the internal parasites is the liver-fluke, a flat worm mainly found in sheep, but also in cattle in the Hawke's Bay region. This parasite has one of the most interesting of life-cycles. It not only parasitizes a warm-blooded animal, but during its growth parasitizes a small fresh-water snail, and then finally causes the death of the sheep. The adult parasite is a flat leaf-shaped worm found in the bile-ducts of the liver. It lays large numbers of eggs, which pass out in the bile and reach damp areas of pasture about creeks and swamps. Here the egg hatches, and a larva swims about in the water. It then attacks a small snail and bores its way through into the liver of that small host. Here several changes are undergone, until the parasites, which have now bred into hundreds in the snail from a single one, are ready to break free once more. When they enter the water they swim about and finally attach themselves to a plant, from which position a sheep picks them off when feeding in the pond or swamp. The larva which was at that time encysted comes into active life once more in the sheep-stomach, and when it reaches the intestine burrows through into the body cavity. Here it crawls about until it finds the liver, into which it burrows until a bile-duct is found and entered, where the the parasite grows until it becomes adult. The parasites when numerous so disarrange the liver function that the pitiable sheep dies with symptoms of dropsy and anæmia. That of course is bad enough, but it was found some eight years ago that these young larvæ entering the liver caused such damage that a certain germ which frequently lurks in the liver could take possession of the damaged area, setting up a spot of necrosis and from there issue quantities of such a strong poison that the affected sheep died within twelve to twenty-four hours. Many thousands of sheep died in that way at one time, until the reason for death was found, and control of the fluke attempted. Control, when you study it, is easy, for if you break the life-cycle of any parasite it must die out, and to break the life-cycle of the fluke it is only necessary to kill the snail. This was done by means of drainage and copper sulphate on many farms in Hawke's Bay, with the result that whereas annually large numbers of sheep at one time died mysteriously and suddenly this now does not occur. Some drugs, too, were found to act on the adult fluke in the liver, and therefore by drenching sheep and by treating swamps one gets 100 per cent. efficiency in killing off fluke.

Tape-worms are a source of considerable loss to the farming community in New Zealand, and also the general public when one realizes that in New Zealand some eighty operations are performed annually on human beings to free them from hydatid cysts which have been contracted from dogs. There are a number of varieties of tape-worms, but the true tape-worm is one of the parasites which have two hosts, the one in which they exist as adults, and that is usually a carnivorous animal, and the other where they exist in larval form, and that host is herbivorous or omnivorous and possibly able to be eaten by the carnivors.

The general life-history is this : An adult tape-worm in the intestine of the dog, for example, drops segments off the end of the whole tape-worm and these segments pass out in the fæces to the ground. Each segment is full of large numbers of eggs, which, when the segment dries and ruptures are liberated in the vicinity and may blow about in the dust or get carried about by animals, or very frequently by the dog itself, owing to the objectionable habit of dogs, or to the fact that some dogs are not given sufficient liberty to get away from their kennels to defæcate. Susceptible animals later take in such eggs with their food. The egg ruptures and liberates a larva which passes through the intestinal wall and may enter the blood-stream to pass to various organs of the body, or they may crawl to the liver and enter it or to the lungs to grow into the next stage, the bladder-like cystic stage. In the parasite affecting man the cyst stage grows quite large, numerous small heads being formed inside the cyst, each head capable when it gets back to the dog of forming another tape-worm. In addition, in man what are called daughter cysts may form, and if these get loose in the body of the host the outlook becomes serious. Usually hydatid cysts are picked up by children and the result of their growth is not felt until the child becomes adult.

Where the farmer sees the parasite is in the liver and lungs of his sheep. In cattle the cysts, when formed, are sterile and are not dangerous, but it is the sheep which perpetuates the disease and so makes the country dog a danger to children. So many cysts are present in the livers of sheep in New Zealand that it is difficult to get sufficient sound livers for export purposes. That offers a distinct menace to country districts, for the majority of country dogs are affected with the adult form of the parasite—the tape-worm. Town dogs, it must be stressed, are not affected by this parasite, because they do not get the opportunity to feed on sheep carcasses or offal, and their meat is previously inspected by trained Inspectors at abattoirs before being sold. The only efficient way to control this parasite is by prevention, and that should offer no difficulty if the farmer controlled his dogs' food. Livers and lungs, if given to dogs, should be boiled, and on no account should dogs be allowed to wander and eat dead sheep about the farm. It is possible also to clean the parasite out of dogs fairly well by dosing them with Areca nut or with Arecoline hydrobromide, which is a purer form of the Areca nut, and this dosage should, in the country, be repeated every three months.

There is a similar life-history in tape-worms between the cat and the mouse, the dog and the rabbit, the dog and his louse, and in some-countries—not this—man and the cow. Poultry also suffer gravely from tape-worm, and they perpetuate the parasite by eating slugs, beetles, and earthworms which harbour the larval stages.

Round worms too can be dangerous, and their life-histories are full of interest. Trichinosis is a disease of pigs, rats, and man fortunately not known in New Zealand, where the larva of a little round worm establishes itself in the muscles of the person who eats the affected pork. The common large white worm known as the Ascaris is not content to propagate by a simple method, but the eggs passed out in the fæces and later returning to the stomach

through the mouth hatch out larvæ which burrow through the intestinal wall and wander round the body in the blood-stream, often until they get into the lung. Here they burrow into a bronchial tube and get coughed up, often at this stage causing a severe bronchitis. The material coughed up is then passed down to the stomach and the worm then becomes adult. Bronchitis in children and pigs is not infrequently caused by the passage of these large round worms' larvæ.

Sheep and calves and pigs suffer considerably from lung-worm, and on a still night considerable coughing can be heard round flocks of adult sheep and hoggets. Some of the worms causing this irritation pass as larvæ or eggs from the lung, are swallowed and pass out with the fæces, and then enter a water snail where they moult. They then again gain entrance to the sheep and pass by way of blood-vessels to the lungs after burrowing through the intestinal wall.

It is an extraordinary thing how seldom parasites lose their way in the animal body during their strange journeyings up and down the internal organs. Some sense guides them, nature apparently keeping on the winning-side when the host has not observed the laws of cleanliness.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 16th November to 14th December, 1933, include the following of agricultural interest:—

No. 70482: Device for holding nozzle of garden-hose; R. G. Bell. No. 70963: Holders for butchers' knives; A. S. Cross and S. E. Smith. No. 71043: Egg-grader; W. G. Taylor, O. Boucher, and M. V. Blake. No. 71093: Concrete butt; Hill Imperishable Post Butt Co., Ltd. No. 69185 and No. 69186: Treatment of meat; Smith Wilkinson Proprietary, Ltd. No. 69323: Fencing-staple; H. C. Rasmussen and G. Phillips. No. 70539: Sheep-dipping; C. Lilley. No. 70937: Refrigerating, Imperial Chemical Industries, Ltd. No. 71026; Wool-cleaning; W. Vicars. No. 71129: Coating for cured meats; J. C. Hutton Pty., Ltd. No. 71141: Gate fastener; W. A. Stephenson. No. 71159: Fertilizer; Cresco Fertilizers, Ltd. No. 71164: Fertilizer; J. A. Heskett.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

Oil Spray Experiments on Red Mite Eggs.—The Entomologist, Plant Research Station, reports that numerous tests on the ovicidal effect of sprays on red mite eggs were carried out during the winter last year. The experiments indicated that 90 per cent. of the winter eggs of the mites are susceptible to oil treatment when the oil is applied at a concentration of 1–10.

Cropping to Control Blackberry.—Experience in the North Island points to the need of two ploughings and two crops in one year to control blackberry. A common practice is to plough in late winter or early spring and sow a crop of turnips or rape, giving a heavy (say, 3 cwt. to 4 cwt. an acre) dressing of suitable fertilizer, so as to ensure a heavy crop, which is fed off in January or February. The land is reploughed at once and given a heavy seeding of a cereal crop—*e.g.*, Algerian oats, or Algerian oats and tares preferably, and again fertilizer is applied liberally. Usually only odd plants survive this cropping, and they can be pulled out by hand at a third ploughing.

AGRICULTURAL LEGISLATION OF 1933.

A. E. MORRISON, Head Office, Department of Agriculture, Wellington.

LEGISLATION enacted during the New Zealand parliamentary session of 1933 and directly coming within the scope of the Department of Agriculture consisted of the Agricultural and Pastoral Societies Amendment Act, the Co-operative Pig-marketing Companies Act, the Dairy Industry Amendment Act, the Orchard-tax Amendment Act, and the Poultry-runs Registration Act. The following notes set out the position briefly with respect to each Act :—

AGRICULTURAL AND PASTORAL SOCIETIES AMENDMENT ACT, 1933.

The Act confers power on societies incorporated under the principal Act to make by-laws controlling the admission of persons to Agricultural and Pastoral Association shows. The by-laws may provide for the exclusion from agricultural and pastoral shows of specified classes of persons either absolutely or subject to such conditions as may be prescribed therein ; for the issue of licenses to specified classes of persons, and for the exclusion of persons of a specified class unless they are duly licensed.

No by-law or any amendment or revocation thereof shall be made until a draft is submitted to and approved by the Governor-General, and no such by-law shall come into force until it is gazetted by the Minister of Agriculture

Licenses which may be issued either by the society making the by-laws, or by any authorized society or person or body of persons, shall enure for a period not exceeding two years or such lesser period as is prescribed in the by-laws. No license shall be issued to any person under the age of sixteen years.

Any person of a class in respect of which a license is required who has been refused a license or whose license has been revoked is given the right of appeal to a Magistrate or to two Justices whose determination on such appeal shall be final and conclusive.

CO-OPERATIVE PIG-MARKETING COMPANIES ACT, 1933.

This statute confers on co-operative pig-marketing companies on becoming registered thereunder the same rights in relation to the surrender and reissue of shares as are possessed by co-operative dairy companies under Part III of the Dairy Industry Act, 1908. The general rule is that a company may not accept surrenders of its own shares. For the purposes of the Act a co-operative pig-marketing company is defined as a company which is incorporated under the Companies Act (whether before or after the passing of the Act) the principal object of which is the treatment for human consumption of pigs supplied to the company by its shareholders and the marketing of the produce, and of the shares issued by which not less than 60 per cent. in nominal value are held by persons engaged in supplying pigs to the company.

The provisions of the Act follow, with the necessary modifications only, the corresponding provisions of the Dairy Industry

Act, 1908, relating to co-operative dairy companies including section 8 of the Dairy Industry Amendment Act, 1926.

The administration of the Act is a matter for the Registrar of Companies.

DAIRY INDUSTRY AMENDMENT ACT, 1933.

In general terms the Act confers additional powers to regulate the dairy industry by way of regulations under the Act requiring the registration of persons competent to be employed as dairy-factory managers with power to set up a Registration Board for the purpose, and regulating the supply of milk or cream to dairy factories by restricting suppliers from transferring their supply from one dairy factory to another during the same manufacturing season.

With regard to the registration of dairy-factory managers, it is anticipated that regulations on the subject will be made and brought into operation for the commencement of the next manufacturing season.

In May last a regulation was made restricting the transfer of supply of milk or cream, but was subsequently challenged and declared by the Court of Appeal to be *ultra vires* the Dairy Industry Act, 1908. The amending Act under notice removes all doubts as to the power of the Governor-General in Council to make a similar regulation in the interests of the dairy industry generally, and the necessary action to this end is now being taken.

By section 5 of the Act any person who is aggrieved by the operation of regulations governing the registration of dairy-factory managers is given the right of appeal to a Magistrate and two assessors, one to be appointed by the appellant and one by the Minister of Agriculture or his nominee. Any person similarly aggrieved in respect of the operation of regulations restricting the transfer of supply of milk or cream from one dairy factory to another is given the right of appeal to a Magistrate exercising jurisdiction in the locality in which the appellant's dairy is situated. In either case the determination on appeal shall be final.

By section 3 of the Act any dairy company is empowered to make an annual charge to cover the cost of accounting in respect of assignments or orders made by a supplier on moneys payable to him for milk, cream, &c., supplied to the company. Such charge shall not exceed £1 or 2½ per cent. of the amount of all such assignments or orders, whichever sum is the less. The annual charge may be deducted from the amount payable under the assignment or order, and the sum so deducted may be recovered from the supplier by the person entitled under the assignment or order. The authorized charge may be made in respect of moneys paid after the passing of the Act in terms of an assignment or order given or made before the passing of the Act.

ORCHARD-TAX AMENDMENT ACT, 1933.

Under the Orchard-tax Act, 1927, an orchard-tax at the rate of 1s. per acre is imposed for the general purposes of the fruit-growing industry; in addition, a special tax not exceeding 5s. per acre may be imposed in commercial fruitgrowing districts to

provide funds for protection against fireblight. As fireblight does not attack citrus or stone fruits, the amending Act exempts from special orchard-tax (fireblight tax) those orchards in which such fruits are exclusively grown, or, in the case of mixed orchards, those areas that are used exclusively for the production of citrus or stone fruits.

By section 3 of the statute provision is made for payment out of the proceeds of the fireblight tax to members of Fireblight Committees of fees in respect of their services.

POULTRY-RUNS REGISTRATION ACT, 1933.

This statute makes provision for the registration of premises used for the keeping of certain poultry and the production of eggs for sale. Provision is made for the payment of fees for registration for the purpose of providing funds for the organization and development of the poultry industry.

The Act does not apply to poultry other than hens and ducks, nor to hens and ducks less than six months old, nor to persons keeping less than twenty-five such birds or keeping poultry for their own use, and not producing eggs for sale. Save as above, every poultry-keeper producing eggs for sale is required to register his premises in the month of June in each year or within one month after the establishment of the poultry-run. Registration will be effected in accordance with regulations to be promoted for the purpose and brought into force prior to 1st June next. For the purposes of the Act a poultry-run is deemed to be established when it is established for the purpose of producing eggs for sale or when any eggs produced in it are sold or offered for sale. The fee for registration is 2s. 6d. per hundred head of poultry kept on the premises at the time of application for registration. No fee is payable, however, where a person is exempted by the Minister of Agriculture from liability to pay the same by reason of undue hardship or other sufficient cause.

The Act provides for the setting-up of a Board called the New Zealand Poultry Board, comprising two Government representatives and four producers' representatives. In addition to being charged with the administration of the Act and of the regulations governing registration, the Board is empowered to organize and develop the poultry industry, and may exercise such powers, not inconsistent with the statute, as are reasonably necessary for the effective performance of its duties and functions. Amongst other things, the funds of the Board may be applied in reimbursement of reasonable expenses, not exceeding £500, incurred by the New Zealand Poultry Association in organizing the poultry industry before the commencement of the Act and in payment of subsidies, if approved by the Minister of Agriculture, to producers in respect of the export of eggs.

The statute contains provision for the taking of a poll of the payers of fees on a proposal that the Act be allowed to expire in 1937. No poll shall be taken, however, except on a petition presented to the Minister of Agriculture during the month of February, 1937, and signed by not less than 20 per cent. of the payers of fees. If a poll is necessary it must be taken not later than 30th April, 1937, and may be taken by post. If a poll is taken and the proposal that the Act

be allowed to expire is carried, the statute shall continue in force until 31st May, 1937, and shall then be deemed to be repealed, whereupon, before or after that date, the Governor-General in Council is empowered to dissolve the Board and to make such provision with respect to the distribution of the Board's assets as is deemed equitable.

General.

For the purposes of providing a method by which sodium chlorate might be made available to farmers for the eradication of noxious weeds, particularly ragwort, at as cheap a rate as possible section 48 of the Finance Act, 1933 (No. 2), empowers County Councils to purchase sodium chlorate in bulk at the best price obtainable and to sell the same or distribute it free in such quantities and on such terms as they think fit. Special loans are authorized to be raised for the purpose without taking the steps prescribed by the Local Bodies' Loans Act, 1926, and the moneys received from the sale of this material may be applied either in the purchase of additional supplies or in repayment of the loan.

The Auckland Metropolitan Milk Act, 1933, provides for the setting-up of a council called the Auckland Metropolitan Milk Council, consisting of nine members, of whom three members shall represent the Auckland City Council, while the other local authorities within the Auckland Metropolitan Milk District, as defined in section 3, the milk-vendors, and the dairymen producing milk for sale within the district shall each be represented by two members. The Council is clothed with all necessary powers to regulate and control the collection, treatment, carriage, deposit, storage, distribution, and sale of milk for human consumption within the metropolitan district, including price-fixation from the source of supply to the consumer.

WHAT IS LIMONITE?

EXPLANATION AND WARNING.

B. C. Aston, Chief Chemist, Department of Agriculture, Wellington.

Limonite is one of the brown hydrated oxides of iron produced by the natural processes of weathering from the parent rocks and containing 14·4 per cent. of water of combination, a variable quantity of moisture, impurity (earthy matter), and about 60 to 80 per cent. ferric oxide. Limonite occurs in nature as massive (rock-like) deposits or occasionally as an earthy (soft) form, and also mixed with clay as "yellow clay ironstone." Limonite also exists in most soils which owe their colour to oxides of iron; limonite giving a brown colour, göthite a yellowish colour, and hæmatite a red colour. It will be convenient here to tabulate descriptions of these compounds for the purpose of seeing at a glance the character and composition of the pure material.

In addition to these three forms of ferric oxide, there are to be found in many North Island soils black grains which are magnetic ironsand (chiefly Fe_3O_4) and, from their persistence in soils, they are evidently insoluble in soil water. The substances mentioned above are the commonest forms of iron met with in nature, although there are many others to which it is not here necessary to refer.

Three Minerals containing Ferric Oxide.

Name of Mineral.	Chemical Formula.	Character.	Combined Water.	Ferric Oxide.
			Per Cent.	Per Cent.
Limonite ..	$2Fe_2O_3,3H_2O$	Non-crystalline, powder, brown	14·4	85·5
Göthite ..	Fe_2O_3,H_2O	Crystalline, powder, brownish-yellow	10·1	89·9
Hæmatite	Fe_2O_3 ..	Sometimes crystalline, powder, red	Nil	100·0

Many experiments with sheep and cattle have shown that Whangarei limonite when air-dried, finely ground, and mixed with medium-grade salt, is readily eaten by stock in the typically bush-sick districts of the North Island, and thus effectually and economically prevents bush sickness where the mortality, without mineral treatment or changing of stock to other areas, is 100 per cent. It also increases the production in localities where mature cows are only slightly affected, and enables young stock to be raised where there is usually heavy mortality. Limonite may be given to calves supplied in the feed milk, about a teaspoonful to a bucket, with excellent results, and suspended in water is effective for curing bush sickness in sheep and lambs.

There are strong reasons for thinking that in some districts remote from the typical bush-sick areas where young animals suffer from a malnutrition the symptoms of which are emaciation and anæmia, on land of high quality, that limonite will enable the young stock to grow and develop normally. There is therefore no doubt that limonite is destined to play a considerable part in the compounding of licks for animal consumption generally, as well as for use on the special pumice areas where the administration of iron licks to stock is an essential and now well-recognized addition to farm routine.

It has been a common practice to introduce about 5 per cent. of an iron salt into proprietary licks for stock, and for this purpose sulphate of iron (ferrous sulphate) has been the salt used. This is not nearly so efficient as limonite in combating bush sickness, and sheep evidently do not like the taste of soluble iron compounds. Several lick-makers are therefore using the limonite from Kamo (Whangarei) deposit or from one farther north (Okaihau) to replace ferrous sulphate. It is necessary to emphasize the instructions given on page 3 of "Control of Bush Sickness in Sheep" pamphlet, which described the method of feeding limonite and the results obtained. (See this *Journal*, June, 1932, page 369, "They were warned against employing artificial heat and were asked to employ air-dried material in order to ensure that it was in as natural a state as possible so far as the solubility was concerned.") Manufacturers should take note that it is undesirable to heat limonite artificially. The greatest success from limonite has been from a factory where only air-drying is practised and where the spalls of ironstone quarried from the deposit near the surface are piled up into great heaps as shown on page 370 of this *Journal* for June, 1932, allowed to air-dry as much as possible, and then broken, crushed, and pulverized in reducing-machinery and put through a fine sieve, after which the powder is ready for use as a lick, only requiring to be mixed with an equal weight of salt. As might have been expected, the sieving of such a moist substance is

not easy, and clogging takes place to a considerable extent. The natural impulse to make the powder more granular by heating in order that the sieving may be speeded up must, however, be resisted, as there is no doubt that a baked limonite will be far less effective than one that is merely air-dried. The heating of limonite much above the ordinary temperature of the air is sufficient to change its colour from brown to a reddish-brown. Limonite is probably a very unstable mineral, and this, combined with insolubility in water, indicating tastelessness, affords an explanation why it is so successful in supplying available iron to ruminant stock. Limonite has the same percentage composition as the artificial yellow ferric hydrate ($2Fe_2O_3,3H_2O$) made by adding ammonia to ferric chloride dissolved in water. By boiling this precipitate in water for seven or eight hours the colour changes from ochre yellow to brick red, and the hydrate thus altered is scarcely acted on by strong nitric acid and but very slowly by hydrochloric acid.

In preparing the natural hydrated limonite for consumption as a stock-lick, caution should therefore be exercised in three directions if the compound is to have efficacy as a cure for iron deficiency or bush sickness in stock.

(1) The material must on no account be artificially heated in order to facilitate sieving, and should be dried by wind and sun only. A warning against overheating was given to the first manufacturers of ground limonite for stock in June, 1932 (see *Journal*, June, 1932, page 369), and this firm has never departed from the original method and has never had a failure—a very satisfactory record.

(2) The material must be ground as finely as possible, as sheep refuse to eat a material which is too gritty.

(3) No lime or other alkaline material should be mixed with the lick. Salt of medium-grade fineness is the best inducement for stock to eat limonite, but in districts near the sea, or places where stock refuse to be attracted by salt, the ground limonite must be mixed with something that is attractive, such as molasses.

There are, fortunately, in the far North of New Zealand inexhaustible supplies of limonite lying near the surface. There is therefore no reason why this abundant and cheap material should not be fully utilized throughout the Dominion. The efficacy of any iron oxide other than limonite from Whangarei, or one of the same nature and composition, should be carefully tested by field experiments before being placed on the market.

RETIREMENT OF MR. R. H. HOOPER AS EDITOR.

RECENTLY Mr. R. H. Hooper, who had held the position of Editor to the Department of Agriculture, which included editorship of the *Journal of Agriculture*, for over eighteen years, retired on superannuation at the statutory age of sixty-five. He was farewelled by officers of the Department and Dr. C. J. Reakes, Director-General of Agriculture, who made happy references to Mr. Hooper's personal qualities, presented him, on behalf of the Department's staff throughout the Dominion, with a high-grade English clock suitably inscribed and with a handsome fruit-bowl for Mrs. Hooper. Mr. Hooper joined the Department in 1900. After two years he was allotted overseas work mainly of a publicity nature for the State. Subsequently he was reappointed to the Department and occupied various positions, including that of District Agent at Wanganui, before being appointed to the editorship of the Department in 1915.

SEASONAL NOTES.

THE FARM.

Utilization of Forage Crops.

CROPS providing feed in late summer and early autumn are sometimes not used to the best advantage. In illustration of this is the fact that, in dairying, crops such as millet, maize, or turnips, used when they are most urgently needed, may eventually give greater cash returns than if they were used when fully grown. The heavy fall in butterfat production that often occurs in February is serious not only because of its direct effect on the returns for that month, but also because, unfortunately, a herd which falls off in its production at an unduly rapid rate at that period is unlikely during the several remaining months of the producing season to return to the standard of production it would have maintained had there not occurred an unsatisfactory supply of feed in February. From this it follows that in late summer it is sound practice to use special crops grown to supplement the pastures, not necessarily at the peak of their yield, but at the peak of their economic effectiveness.

Another aspect of the same matter is the fact that green crops such as millet, red clover, and lucerne are at times allowed to become too mature and woody before being fed to stock. Usually at this season the qualities primarily needed in crops used for green feed are high digestibility, high mineral content, and high content of the particular substances called proteins, which are required for milk and meat production. In all these vital qualities there is a decline in green feed as it approaches maturity. Hence the mere provision of green feed does not ensure proper feeding at this season. The nature of the green feed is of prime importance—such feed should be practically free from fibre or woodiness—*e.g.*, soft turnips or young succulent leaf growth. These considerations make clear the reasons why at times good milk yield does not result from freely feeding such crops as lucerne and millet, which, while quite green, have developed the woodiness that is associated with poor feeding-value for stock that are producing heavily or growing rapidly. Incidental to the matter directly under consideration, but of great practical moment, is the fact that the woodiness which proves undesirable in clover, millet, or lucerne also proves similarly undesirable in pastures in which woodiness is associated with flower-stalk development.

As grass silage normally is made from growth in which there has been a considerable development of maturity and woodiness, it follows from the preceding statements that grass silage at times is not a completely satisfactory feed with which to supplement pastures in summer and autumn, and that the extent to which it proves unsuitable for this purpose depends upon (1) the degree of maturity reached in the material used in the production of the silage, and (2) the productive capacity of the stock.

Silage made from growth mown when at a stage less mature and more leafy than that normally adopted in mowing for hay would be less woody and more digestible than silage made from growth mown at or after reaching the stage when cutting for hay is ordinarily carried out. Again, silage of a particular degree of maturity might be quite suitable for the summer supplementary feeding of cows producing not more than 1 lb. of butterfat daily, but unsatisfactory for the feeding of cows producing in the vicinity of 2 lb. of butterfat daily. Further, the type of pasture growth fed in conjunction with silage would influence the suitability of the silage as a

supplementary feed—silage supplementing distinctly leafy pasture might be quite satisfactory whereas the same kind of silage supplementing stemmy pastures might give definitely poor results. Probably also the nature of the curing which silage has undergone influences its suitability as a summer supplementary feed. From farm experience in New Zealand it has been concluded that silage cured so that it is greenish to dirty yellow in colour is more suitable in its protein content—which is of much moment—for highly producing stock than silage subjected to curing which gives it a brownish to black colour, and the findings from New Zealand farm experience are supported by the results of recent systematic research in Europe.

To sum up, the suitability of silage as a feed to supplement pastures in late summer and autumn is influenced by—(1) the maturity of the material used in the making of the silage; (2) the production of the stock to which it is fed; (3) the nature of the pasture supplemented by the silage; (4) the type of curing the silage undergoes.

Hence the value of silage for the purpose of supplementing pastures in summer is determined to a large extent by circumstances, and so we find some, basing their remarks on experience, roundly condemning the summer use of silage as a pasture supplement and others, also speaking from experience, just as emphatically commending it. From the position as outlined above, it should be clear that the contradictory views may be correct interpretations of the different sets of experiences upon which they are based. But generally the silage produced under current practice is not so fitted to lead to a reasonably high production of butterfat as non-woody feeds such as soft turnips, kales, and leafy clover or grass. Actual instances have been recorded in which changes in summer supplementary feed from silage to soft turnips and to chou moellier have been followed by an increased production of butterfat. However, it is of importance to bear in mind that although silage may not generally be the ideal material for supplementing dairy pastures in summer it undoubtedly is of value for this purpose—a fact the truth of which thousands of farmers can testify.

Pasture Establishment.

Apart from districts in which relatively early heavy frosts occur, autumn sowing of seed for permanent pastures is, on the results of field experience, much favoured. March sowings are considered generally to give the best results, chiefly because in March the soil frequently possesses the conditions of moisture and warmth which allows of rapid and vigorous establishment. The sowings which at times are made in late autumn or early winter are prone to be associated with poor establishment, especially of the clovers; a sowing which is too late by only a few days may give a markedly poorer sward than a similar one made far enough ahead of the advent of conditions unfavourable to pasture seedlings.

In general, the sowing of companion crops such as oats with pasture seeds is not justified. At times such crops have been employed partly on the grounds that they provide shelter to the pasture seedlings. Actually they readily provide too much shelter and reduce to an undesirable extent, not only the supply of soil moisture, but also that of direct light, and, of course, the better the companion crop the more intense will be this undesirable effect. Hence, while the value of such companion crops as a means of obtaining additional early feed is undoubted, that value may be more than offset by the harmful effect of the crop on the pasture—an effect which ordinarily would be felt over a number of years. Exceptional cases may justify the use of companion crops, and in these cases white oats or barley may suitably be used. In the interest of the pasture, the amount of cereal-seed used should be less than if a cereal crop alone were being sown.

Some points of general moment in pasture establishment are—

(1) Since the introduction of certification of seed, each year has given additional conclusive evidence that the use of certified seed is economically well worth while.

(2) The necessity for a fine firm seed-bed is great, and neglect relative to this is fruitful of unsatisfactory results.

(3) Top-dressing at the time of sowing of seed frequently contributes materially to vigorous successful establishment. As a rule, it is well to top-dress early—in time to prevent the onset of deterioration, instead of being faced with the need of top-dressing later in an endeavour to repair a sward which has deteriorated.

(4) The advisability of rolling at seed-sowing time is governed by circumstances. One rule of some value is to roll under dry fine conditions and not to roll under wet conditions with frequent rain.

Pasture Seed Mixtures.

Detailed information about seed mixtures for specific purposes and conditions is available from local officers of the Fields Division. For general guidance the following mixtures are recommended by Mr. E. Bruce Levy, Agrostologist, Department of Agriculture :—

A. For wide use in both North and South Islands on country with a carrying-capacity which is or can economically be made at the rate of one cow to 2 or 3 acres or better, or at the rate of 2 to 3 ewes to the acre or better : True perennial rye-grass, 20 lb. to 25 lb. ; New Zealand cocksfoot, 10 lb. to 15 lb. ; crested dogstail, 3 lb. ; Timothy, 3 lb. ; New Zealand white clover, 2 lb. ; red clover, 3 lb. : total, 46 lb.

Amounts given in this and other mixtures are per acre. The smaller amount of rye-grass is to be used mainly when the summer rainfall is below that needed for good results with rye-grass, and under these conditions the larger amount of cocksfoot is advisable, as it also is when it would not be economically attractive to raise the fertility of the land by top-dressing up to standard of fertility required by successful rye-grass.

B. For temporary pastures of one to two years' duration : Italian rye-grass, 25 lb. to 30 lb. ; red clover, 6 lb. : total, 31 lb. to 36 lb.

For a temporary pasture to serve as an autumn-sown catch-crop to be followed by another spring-sown crop, genuine Western Wolths, on account of heavy early growth, could usefully replace Italian rye-grass, which, however, should be employed in all temporary pastures other than autumn-sown catch-crops.

C. For short-rotation pastures which are intended to have a life of two to three years : Italian rye-grass, 15 lb. ; perennial rye-grass, 15 lb. ; red clover, 4 lb. ; white clover, 2 lb. : total, 36 lb.

Short-rotation pastures are useful mainly on farms on which, largely because of climatic conditions, arable crops instead of pastures are the dominant concern.

D. For sowing the primary burn out of the bush : Cocksfoot, 8 lb. ; crested dogstail, 3 lb. ; Italian rye-grass, 4 lb. ; true perennial rye-grass, 12 lb. ; Poa pratensis, 1 lb. ; brown-top, 1½ lb. ; white clover, 2 lb. ; Lotus major, 1 lb. ; Danthonia pilosa, 3 lb. : total, 35½ lb.

E. For the sowing of secondary-bush burns—typical bracken, hard fern, and manuka burns : Perennial rye-grass, 8 lb. ; brown-top, 2 lb. ; dogstail, 4 lb. ; white clover, 1 lb. ; Lotus major, 1 lb. ; Danthonia pilosa, 3 lb. : total, 19 lb.

Minor modifications of most of the above mixtures may at times be advisable. Advice relative to these modifications is available from district officers of the Fields Division.

Pasture Management.

Topping of pastures as described in last month's notes may be advisable in March. As grass harrowing during dry summer conditions is seldom advisable it is often good practice, as soon as March rains occur, to push ahead with harrowing in order to minimize delay in distributing droppings which have accumulated during the summer.

In the main grass-farming districts, top-dressing with phosphates during the February–April period is widely advisable. One of the important advantages of such top-dressing is that it usually brings about prior to the dormant winter period an appreciable increase in growth which is valuable because it assists not only in increasing the winter supply of feed, but also in enabling stock to enter the winter with additional vigour and condition which stands to them in later critical periods

A second material advantage of fall top-dressing is that, while it stimulates growth in the early spring practically to the same extent as would spring top-dressing, it is declining in its effect by the time summer is reached, and so does not cause such a rush of growth as does spring top-dressing—a rush which tends to intensify the practical difficulties in effecting satisfactory control of pasture growth in early summer.

Emergency Catch-cropping.

Land from which such crops as oats, wheat, maize, millet, soft turnips, or rape have just been removed may often advantageously be ploughed and sown without delay in temporary pasture, oats, or barley in the manner described in last month's notes. If such land is so hard as to make satisfactory skim ploughing impracticable, then cultivation with disks set with plenty of cut will often serve suitably as an alternative to the skim ploughing. The crops mentioned above, and especially the temporary pasture, should as a rule be sown with as little delay as possible.

It is not necessary to reduce to a fine condition the surface layer of the seed-bed of autumn-sown crops. In fact, the occurrence of clods is at times definitely advantageous—they prevent the caking of the surfaces which heavy beating rains may produce on soils the surface layers of which have been worked down to a fine condition

—R P. Connell, Fields Division, Palmerston North.

Measures against Internal Parasites.

From now onwards in the dairying districts farmers will guard against the presence of internal parasites in their young calves. The worms causing a characteristic cough in young calves are located in the small tubes of the lungs. The other worms which cause scour, loss of condition, and even emaciation are located in the fourth stomach and small intestines. These parasites frequently infest young growing calves during the autumn months, being more severe on farms which are low-lying, on farms subject to flooding, on farms where overstocking is carried out, and on all farms in a wet or showery autumn.

The worms in the small tubes in the lungs cause "husk" or "hoose" in calves, often spoken of as lung-worm disease. The other parasites in the stomach and intestines cause inflammation of these organs, resulting in scouring and loss of condition. It is partly on account of parasites such as these that certain paddocks on a farm become what is known as "calf-sick." It is therefore advisable to guard against any of the above predisposing factors which encourage the spread and growth of parasites in young stock. It is scarcely necessary to state that parasites have a decidedly retarding influence on the growth and development of all young stock, apart altogether from the mortality which they cause from year to year.

As these notes will appear in plenty of time to allow owners to take steps to prevent the damage done by parasites from becoming serious, it is necessary to state here only that no better means of prevention can be adopted than by increasing the food ration from now onwards. A change of pasture is advisable, a paddock which has not been grazed by young stock being the most suitable. A crop of aftermath following a cutting for hay or ensilage often provides suitable grazing for the purpose. If such a crop is not available affected calves should be given a supplementary ration of crushed oats and moose nuts. In addition it is advisable to provide a salt lick, especially a lick containing iron in some form. As infested stock are invariably anæmic, the iron content of the lick is necessary to assist in the maintenance of the red-cell content of the blood. A suitable lick may be composed of nine to nine and a half parts of salt with from a half to one part of limonite added. Under such conditions of feeding and good husbandry it may not be necessary to resort to drenches and medicine for the eradication of worms. This result is to be desired, as prevention is always better than cure. Moreover, in badly infested calves, even though drenching is resorted to, it is still necessary to increase the food-supply to overcome an attack.

J. E. McIlwaine, Veterinarian, Live Stock Division, Wellington.

THE ORCHARD.

Seasonal Spraying.

GROWERS are again urged not to cease spraying operations until all danger from insect and fungi attack is over. Should the autumn prove to be hot and dry, red-mite, apple-leaf hopper, codling moth, and leaf-roller caterpillar will still be active and capable of causing much damage to the fruit and tree if left uncontrolled. On the other hand, a wet or even a damp autumn will be favourable for fungous diseases, particularly black-spot infection. It is possible that the average grower does not realize the paramount importance of keeping red-mite and apple-leaf hopper under at least reasonable control. From a control point of view, these insects may be grouped together: their habits and methods of feeding are similar in so far as both are sucking insects finding a common feeding-ground chiefly on the underside of the foliage. Unlike the injury caused by codling-moth and leaf-roller caterpillar, that caused by these pests may not result in visible injury on the fruit. Their attack on the foliage, however, is often so severe as not only to weaken the tree, but to reduce the crop by causing the fruit to fall. In addition, it may prevent fruit buds for future crops from developing. Thus, indirectly, the invisible injury to fruit caused by red-mite and apple-leaf hopper may easily result as disastrously as that caused by uncontrolled codling moth and leaf-roller caterpillar. It is advisable to continue with the combination spray as directed in last month's notes for control of black-spot, powdery mildew, codling moth, and leaf-roller caterpillar. For red-mite and apple-leaf hopper apply summer oil 1 per cent. to 2 per cent.; at least two applications at ten-day intervals will be necessary to achieve a satisfactory control. Care must be taken, however, not to apply summer oil until fourteen days have elapsed preceding or following sulphur in any form. From about the latter end of February and during the month of March red-mite winter egg-laying will commence, unless, of course, all live mites have been destroyed during the preceding month. Satisfactory control of red-mite may be achieved provided the operator is thorough in his work when applying the spray and does not delay the operation until after egg-laying has actually commenced.

Spraying stone fruits as recommended in December notes should be carried out.

Fruit Export.

Practically all packing-sheds will, ere this, be in commission as centres for the purpose of grading and packing fruit for export and for local markets. This subject was dealt with in last month's notes, therefore there is little that can be added to these notes except once more to stress the necessity for careful handling of all fruit, whether for export or for local market, the importance of maintaining the colour standard set for the variety, and the necessity for maintaining a uniform size throughout each case. Packers should be instructed to build the bulge in the case during the process of packing, and not simply fill the case with the required number of apples and leave the bulge to the lidding-press and to chance. The process of building in the bulge is quite simple and may be accomplished by placing one hand on top of the other and pressing into their respective pockets the apples at either end of the case (say, after the third layer has been placed in position) thus causing the pack to slightly pyramid or bulge in the centre. This operation takes very little time and saves considerable loss by eliminating the risk of bruising and cutting the fruit at either end of the case while on the lidding-press. The regulation bulge is 1½ in. top and bottom, not 3 in. on top or bottom only, which is often the case when the bulge is left entirely to the lidding-press.

The Packing-shed.

The packing-shed should be well ventilated, well lighted, and so arranged as to minimize double handling of cases of fruit. Fruit arriving from the orchard should be stacked in close proximity to the grader, from which point it should be moved on gradually from operator to operator until the completely finished case of fruit reaches the loading-out point where it should be carefully stacked ready for dispatch. Empty cases for packing, after being lined with corrugated strawboard or wood-wool, should be neatly stacked handy to the packers. The shed should be swept out at least once a day, and all rubbish such as loose paper and broken wire, &c., collected and destroyed or disposed of in some satisfactory manner. Waste fruit, if left lying in or about the packing-shed attracts flies and, apart from this, it is unsightly and quickly causes a very unpleasant smell. Uncleanliness may be eliminated if all such fruit is collected and placed in receptacles provided for the purpose. When full, or at the close of each day, the receptacles should be emptied and the contents burned or deeply buried.

The grading-machine will need constant attention to be kept clean and in good running-order. The bins should be constantly emptied of all deposits such as broken fruit, spurs, leaves, and dust, &c. On no account should they be overfilled, as overfilling is often responsible for bruising and stalk puncture, &c.

—*J. W. Whelan, Orchard Instructor, Palmerston North.*

Citrus Culture.

Owing to the dry weather experienced this summer, trees are backward in development, and little could be done to assist them, except where irrigation was possible. In order to minimize as much as possible the ill effects of the dry weather it will be well to carry out all possible cultural practices during the coming autumn. After the first rainfall the soil should be cultivated to break the surface, otherwise some of the benefit of the succeeding rains will be lost, as much water will run away. The trees may be expected to make more vigorous autumn growth than usual, and this should be attended to by pinching and spacing in order to ensure that the growth may be reasonably hard to withstand the frosts to be expected later. It is in winters following such seasons as the present one that winter-kill of tips is most common, mainly because the growth is soft.

Unfruitful trees or trees of poor type may be top-worked or budded over to more profitable kinds as soon as suitable bud-wood can be obtained. Shield budding into reasonably fresh bark on the main stems is generally satisfactory, and the limb in which the buds are inserted may be shortened somewhat to check the flow of sap. In selecting buds it is important that wood should be taken from trees of good habit that produce a desirable type of fruit. Strongly growing fleshy shoots and trees prone to developing excessive wood should be avoided, as these characteristics will be perpetuated in the new tree to the detriment of fruit-production. Short twigs on which fruit has been produced will provide the best bud-wood, which for satisfactory working should be round, free from thorns and carrying good plump buds. Triangular or flanged wood is not suitable, inasmuch as a sufficient width of bark cannot be obtained, and it is almost impossible to remove the surplus wood without damaging the eye. In budding seedling stocks it is important that the bud be inserted at least 9 in. above the ground-level to ensure that there will ultimately be a sufficient length of stock to protect the more susceptible varieties against infection by soil-inhabiting fungi such as collar-rot and brown rot.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Culling.

CULLING should be uppermost in the minds of every poultry-keeper at the present time. This is the period when the hens are finally laying before taking a rest prior to undergoing the moulting process, so there is no better time to choose the breeding specimens and to discard the drones. It is at this time, or just before the moulting process commences, that certain signs manifest themselves indicating whether a bird has in the past year been a heavy producer or whether she is likely to be one during the coming season. In a general way, these signs disappear as soon as the birds have moulted so that if this important work is delayed now, it is impossible for it to be carried out to the best advantage at a later date, chiefly for the reason that if left until the flock has fully moulted the matter of choosing between the good and bad layer becomes a difficult one. While the culling of undesirable stock and the selection of the best specimens for the breeding-pens are the chief essentials in successful poultry-keeping, these operations are probably the most difficult to teach the novice to carry out properly, other than by a practical demonstration To those, however, who have not studied laying form throughout the season, some general points may be stated that will serve as a guide to assist in culling out the poor layers.

Other things being equal as to the time of hatching, and provided the flock has received uniform treatment as regards feeding and general management, usually it will be found a safe course to discard birds that moult first, and to retain the late moulters either for breeding or laying purposes. This point cannot be emphasized too strongly What chance has the early moulter in an egg-laying competition ? If first moulters are handled invariably they will be found to be overloaded with fat. They have been converting their food into flesh and fat—that is, if they are not light through having a weak constitution.

The late moulter usually will be found to have no superfluous flesh or fat upon her.

As to culling out the early moulters it is sometimes claimed that the bird which moults first must necessarily be producing when the feathers of the late moulters are being renewed and thereby showing as good a profit for the year as the late moulters. This may be true in some cases,

but generally it is not. It is reasonable that if a bird be a long season layer she must be a late moulter, for it is rarely indeed that fowls moult and continue laying at the same time. It will usually be found that the high-type layer—viz., the late moulter—will lay for several weeks longer in the autumn when the price of eggs is on the up grade than the early moulter, and then, after renewing its feathers, will resume laying before the birds that moult first. Of course, no rule is capable of universal application, and, not unlike all other things connected with poultry, local conditions must always be taken into account. The point cannot be emphasized too strongly that, as a general rule, the birds in their pullet year will commence to moult before the birds a year or more older. Especially does this apply if the latter were late moulters the previous year, so that when first and second season layers are running together, and there is no mark for age determination, the time of moulting will not give a good guide in the work of culling. In order to simplify the work of culling, all young birds should, for age determination, be marked in the web of the foot by a special punch made for the purpose. It is generally admitted that few hens show a satisfactory margin of profit after two laying seasons, and therefore such hens should be heavily culled immediately they show signs of terminating their second season of production. Those who have indifferent flocks would be well advised to make heavy culling, even in the case of those birds finishing their first laying season and, in particular, it is a safe course to discard all birds showing weak constitutions. The rule of keeping all birds until they have passed two laying seasons will not hold in these days of dear foods and low prices for eggs.

The general appearance, apart from the question of the time of moulting, gives a good guide to a bird's productive power at this period of the year. The heavy layer will present a more or less shabby appearance, and owing to this fact is often the first to be culled out by the inexperienced poultry-keeper. Birds which have a well kept glossy plumage and which are usually well above the ordinary weight of the breed, are flesh-makers, and therefore should be culled out. The good layer is always tightly and thickly feathered. Not only does loose feathering denote poor laying-capacity, but impaired constitution as well. The late moulter or the good layer at this season of the year will have well bleached shanks (in the yellow-legged birds); she will also be a heavy feeder, and still retain an active business-like appearance. The poor layer, apart from being an early moulter, is usually very fat, has a well-kept plumage, and bright-yellow legs.

The condition surrounding the abdomen also gives a good guide to laying capacity. In the good bird it will be found full, pliable, and soft to the touch. In the bird about to take her natural rest prior to moulting, it will be observed that the abdomen shrinks and is thick and hard to the touch. Owing to this shrinkage of the abdomen the bird will appear to have much longer legs than when she is in full laying condition.

The head of the bird is also a good guide in the classification of stock. The good layer will have bright prominent eyes, a clean face, free from wrinkles and feathers. Indeed, with the exceptionally heavy layer, it is not uncommon for the head to become completely devoid of feathers towards the termination of her laying season. Of course the feathers are always renewed later. Birds with coarse heads, feathered face, dull or sunken eyes, and wrinkled skin surrounding the eye are usually of poor laying-capacity and low vitality.

While the width of the pelvic bones is not an indication of laying powers, it is, however, a good guide as to whether a bird will lay in the near future, or whether she is taking the natural rest before moulting. If the bones are close together and the breast bone close up to them, it

is a sure sign that the bird will not lay for some time, and therefore will be unprofitable to keep. On the other hand, if the pelvic bones are set well apart, so that they will admit, say three fingers, and there is a good distance between the pelvic bones and the breast bone, and the abdomen is full and soft to the touch it may be taken for granted that the bird is laying or will soon commence to lay and is well worth retaining in the flock for another year or at any rate until she shows signs of moulting.

Selecting the Breeding-hens.

The culls having been removed from the flock, the next important step is to choose the prospective breeding specimens. In this connection it is not to be inferred that all late moulters which give indications of being heavy layers are desirable breeding specimens, for the best layer is not necessarily the best breeding-bird. Breed and laying type, the desired size, together with points indicating constitutional vigour, must be combined if desirable progeny is to be produced. For example, a freak type of bird may prove to be a heavy layer, but, if bred from, its progeny in all probability would prove disappointing. To maintain a flock of heavy producers, the breeder must have an ideal type pictured in his mind's eye, and choose birds as near to this as it is possible to do. Breeding from hens of various types and sizes merely because they have good egg-laying performances behind them is no doubt responsible, to a considerable extent, for much of the weak stock being bred at the present time. The danger of improving one characteristic by weakening another should always be kept in mind. In addition to possessing maximum laying points, the ideal breeding-bird should be at least a fair specimen of the breed it represents. In other words, it should conform to breed type, and have good bodily development. Not only should the back be broad, but there should be a good depth of body, well developed in front, and in the abdominal region. In selecting breeding specimens whether males or females, the first essentials to look for are points indicating strong constitutional vigour. However well a fowl may lay, if she does not possess the desired constitutional points she should not be bred from. The breeding specimen should always be an active bird and never of a sluggish temperament.

It seems well again to emphasize the importance of weeding out all inferior stock, and also of selecting the breeding-stock at the earliest possible moment, for the reason that it is impossible to efficiently carry out this work after the moult has set in.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Final Extracting for Main Honey-flow.

FEBRUARY will probably see the end of the main honey-flow in most districts, and beekeepers will be wise to remove the last of the honey before the colder nights arrive. Once the honey in the hives has been allowed to become thoroughly chilled there is little prospect of its becoming warmed again when uncertain weather sets in. Wherever it is inclined to be thick the honey will be found exceedingly difficult to extract unless it is warm, and the beekeeper who delays too long will find that he will have to return to the hives combs almost as heavy as when they were removed. Thin honey extracts best when it is warm, but it is imperative that thick honey be not allowed to cool before extracting.

Condition of the Brood-chamber.

One of the principal matters to be attended to when the last of the honey is being removed is the condition of the brood-chamber. Many prolific queens keep the brood-chamber so full of brood throughout the season that the bees have very little room to store honey in it. Consequently, if all the honey in the supers is removed such colonies stand a chance of being starved out before the end of the winter. These colonies should not be reduced to less than two stories, and on no account should their stores be less than 30 lb. to 40 lb. It must be borne in mind that all the brood in the hive will hatch and must be fed, and that in addition the queen will continue laying for some months to come, while in some districts breeding may continue throughout the winter. To ensure the colony coming out strong in the spring it must be left with ample stores to carry it through the months of dearth. Unless there is ample evidence of an abundant autumn flow, the beekeeper would be wise to leave his hives oversupplied rather than undersupplied.

Use of Bee-escapes.

For the comb-honey producer the Porter bee-escape is an invaluable aid in the removal of his crop. Removal of comb-honey by the ordinary method of brushing, &c., is apt to result in the piercing of many cell-cappings, with constant leakage; but by the use of this simple little appliance, fitted in a board the size of a super, comb-honey can be removed without any disturbance of the colony. The super or supers should be prized up from the brood-chamber, two or three puffs of smoke driven into the hive, and the board gently slipped into place with the round hole of the escape uppermost. If this is done in the afternoon, by morning the super will be empty of bees.

Prevention of Robbing.

The taking of the last of the honey is the time when the beekeeper must display endless caution to prevent robbing. A bad attack of autumn robbing is—next to disease—about the worst thing a beekeeper can experience. Before starting the day's work he should have all appliances handy, have formed a plan of how the work is to be carried out, and should, if it is satisfactory, adhere to that plan throughout the day. A light barrow fitted with a tray to catch honey-drips, and two or three cloths of a size to cover the whole of a super are some of the things which will obviate much trouble. As the combs are removed from the supers they should be brushed and shaken as free of bees as possible, placed in an empty super on the barrow, and covered with a damp cloth. Every hive should be closed as soon as it is finished with, and the combs removed to the honey-house, which should be bee-proof. At the close of the day the wet combs should be returned to the hives as expeditiously as possible, and by morning the apiary will be found to be in its normal condition. No pieces of wax, spilt honey, or anything likely to attract the attention of the bees should be left uncovered.

If the bees show a tendency to pounce on any particular hive the entrance should be contracted considerably and wet grass piled in front of the hive. If working in one portion of the apiary should cause robber bees to become too attentive it is advisable to shift the scene of operations to another part. It must be borne in mind that autumn robbing once commenced is hard to check and also that it is usually brought about by careless manipulation of the hives.

Weak Colonies.

As far as possible, weak hives should not be tolerated during the winter months. During the warm days these stocks rarely escape the attention of robber bees, and are easily molested. Once they are attacked

it is exceedingly hard to save them, and despite the efforts of the beekeeper they eventually get robbed out. It is usually the presence of weak hives in the apiary that starts autumn and winter robbing, and it is by far the best plan to unite them with stronger colonies in the apiary and avoid the risk of creating a disturbance among the bees when normal winter conditions should prevail. If weak colonies are not detected until late in the season a good plan to follow when uniting them is to put the weak hive on top of a strong one, placing a piece of newspaper between the two hive-bodies. In the course of a few days the bees in the weaker hive will eat their way through the paper and unite peaceably with the bees in the stronger hive. The surplus combs may subsequently be removed, and the hive made snug for wintering. If weather conditions permit, it is advantageous to destroy the queen in the weaker hive prior to uniting.

Preparations for Winter.

As soon as the last of the honey is removed the beekeeper should see that the colonies are in good order for wintering. The first matter for attention is that of stores, which, as already indicated, should be abundant; the second that of the queen's condition. After these two important matters are settled the beekeeper should satisfy himself that his hives are watertight and draught-proof, also that his apiary is well provided with shelter in the form of good hedges or other wind-breaks.

With regard to the queen, autumn is the time when strict attention should be paid to weak and failing queens. None but the best queens should be allowed to go into winter quarters. Poor queens should be destroyed, and either superseded by young and vigorous ones or their colonies united with those of the better queens before the winter sets in. No queen should be tolerated which cannot provide the colony with an abundant supply of young workers before the cold weather arrives. It is quite certain that the queen which goes back in the autumn will be in worse condition after the winter, and will not produce enough workers to provide a surplus in the following season, even if she does not fail entirely before the spring or develop into a drone-layer as soon as brood-rearing commences.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

THE keeping quality of the onion crop in ordinary storage depends very largely on the methods of harvesting and on the conditions in the store. Bulbs with thick necks and deformed ones are unsuitable for long storage, and should be used up at once; but sound bulbs carefully handled to avoid bruising, and with roots and tops thoroughly dried off, have quite good keeping qualities if the conditions in storage are dry, cool, and airy. The conditions just named are indispensable: humidity, occasional high temperatures, and a stagnant atmosphere will quickly depreciate the crop and shorten life. High temperatures are sometimes locally induced by close stacking of considerable quantities, which must be avoided. Moderate quantities may be strung, in the old-fashioned way, and hung up; but in any case ample provision should be made for the cool, dry air to circulate freely through the stored bulbs.

To provide young "spring onions" at that season when salads are so much in demand, a sowing should be made now. For this purpose the Rocca or Tripoli types are most suitable, owing to their mild flavour and tender flesh. In the warmer districts, especially, this crop grows well with little

trouble, and it is generally advisable to make a generous sowing for the purpose above mentioned, and also for planting out the main crop during the month of July instead of making a spring sowing. This method provides an all-the-year-round supply in localities where spring-sown crops are difficult to ripen satisfactorily. The land selected for sowing now should be well drained and thoroughly cleaned of weeds by fallowing and shallow cultivation for some time before sowing.

Pumpkins and squashes are useful for winter supplies in the kitchen. If they are ripe, properly harvested, and stored, they have excellent keeping qualities. It is important that they be well-matured, and cut with a stem attached to the fruit. They should then be allowed to remain where grown for a while to ripen. Subsequently they must be handled and carted with care, as they are easily injured seriously at this stage. When they are stored in a warm airy place for a few weeks their shells harden, and they will then stand somewhat lower temperatures and rougher handling if that is necessary.

On light land and in dry localities where the celery crop is grown in trenches preparation should be made for blanching the plants as required. Suckers and dead leaves about the base of the plants should be removed and such water and liquid manure as may be required should be supplied. In fine weather when the soil is in friable condition it is advisable to gather the leaves of each plant together, and to hold them in position by means of a line with which a turn is taken about each plant, the ends of the line being fastened to pegs in the ground. The soil for filling should be broken fine and filled to a depth of about 4 in. about each plant, and the line then removed. By repeating the operation twice at intervals of about a fortnight the process is completed, and about four to six weeks later the crop will be ready for lifting as required. The plants should be nearly full grown before this operation is commenced. For early crops of the self-blanching varieties, grown without trenches, boards 10 in. to 12 in. wide or stout building paper of that width are laid along the rows. Late varieties grown in the same way are best banked with a mould plough, working the soil up to the plants gradually at intervals.

Sowing of lettuce for winter use and of spinach for spring cutting is seasonable.

Light cultivation to keep down weeds should be given in fine weather to crops sown or planted early in the new year.

Vitamins and Vegetables.

The importance of a good supply of fresh vegetables and fruit in the daily diet has been advocated generally for some time Such distressing troubles as scurvy, beri-beri, rickets, pellagra, &c., it is well known, may be avoided or cured by the inclusion of such foods in the diet. Acute attacks of such deficiency diseases are usually confined to those engaged in heavy manual labour, but " it is now becoming generally recognized that much subnormal health and development, and even incidence of disease, are associated with a partial deficiency of one or more of these accessory substances (vitamins). The influence of such partial deficiencies, even when relatively slight, may be extremely serious." The quotation is from " A Survey of Present Knowledge of Vitamins," by the Medical Research Council, and published by H.M. Stationery Office, London ; 6s. 6d. net. The volume contains important information of general interest, especially to those engaged in the production of primary edible products, and particularly vegetables and fruit.

The first clear evidence of the existence of dietary factors of the nature of vitamins was produced by a physiologist, Lunin, at Basel in Switzerland in 1881. Since then the matter has been the object of research in many

countries, but it was Casimir Funk of the Lister Institute who, in 1907–10, did a great deal of work in the endeavour to actually isolate the active substance to which he give the name of vitamin.

As these accessory food factors called vitamins are sensitive to high temperatures, the value of fresh vegetables and fruit may be greatly impaired by cooking. It appears that the vitamins are best preserved generally by cooking the fruit or vegetables in a small quantity of water for the shortest period of time required to get them tender.

Small-fruit Crops.

Where it is purposed to plant any of these crops, and the necessary shelter-belts, during the month of May, the preparation of the land should now be given every attention, as it is important that the land be thoroughly clean, rich, and deeply cultivated before the plants are set out Any drainage necessary should also be attended to. The commonest cause of failure is hurried and incomplete preparation at the last moment. Planting permanent crops of this kind should never be done until all twitch and other bad weeds are completely eradicated.

The Homestead Garden.

The present time is most suitable for sowing down new lawns or repairing old ones so long as they can be given a rest from hard wear. The good appearance of a lawn depends on its height and an even well-graded surface, its extent in proportion to the vertical masses about it, and an outline that is straight or in bold curves that give it interest As the lawn is a feature that is usually of first importance in the garden, these points should be carefully considered A lawn that has its surface pitched too high and a 6 in. or 10 in. verge beside the drive or walks has its appearance heavily discounted, as also is that of a lawn which sags away from the walks on a lower level: an inch or two above the water-table of the drive or walks is usually a suitable height.

An easy natural slope from the dwelling is usually the best grade for the surface A surface that is approximately level does not look so well, and should only be made for the purpose of games that require it, but in either case it is important that the surface should be smooth, and it is this that takes time, patience, and labour to secure. A smooth surface is best obtained by cultivating the ground to an even depth, breaking it up fine, and giving it time to settle thoroughly. Then by raking it out smooth, rolling it well, and then raking it well again a satisfactory surface may be obtained, or the treatment may have to be repeated to get the desired result. It is important to see that there is at least 6 in. or 8 in. of good soil on the surface: better still is it to have the black soil of equal depth over the whole area Uneven growth of grass in a lawn is often due to the land being levelled without any regard to the depth of black soil, and, as a consequence, considerable areas of turf have sometimes little more than clay beneath.

The experiments now being carried out in green-keeping by the Plant Research Station at Palmerston North indicate that it is generally advisable to apply a dressing of fertilizers before sowing down a lawn. On the heavy river silt on which the experiments are being carried out the following mixture is being used: 6 parts of superphosphate, 3 parts sulphate of ammonia, 4 parts nitrate of soda, and 2 parts of sulphate of iron applied at the rate of 1 oz. of the mixture per square yard every three months. This should be raked in after levelling and followed by the seed, sown evenly, at the rate of 1 oz. to 1 or 2 square yards. Calm weather is necessary for this operation. The seed should be raked in smoothly and then no more attention is necessary until the grass is sufficiently high for cutting. The fertilizers should be mixed immediately before sowing, and finely ground sulphate of iron should be used.

Patches in an established lawn that are worn bare may be seeded down now, but generally it is best to returf them neatly with good turf composed of fine grasses similar to the remainder of the lawn.

The shrubbery and herbaceous borders in a new garden should be deeply cultivated—trenched for preference—thoroughly cleaned of all bad weeds, and the herbaceous border especially should be generously treated with a dressing of decayed farm manure worked in chiefly in the bottom of the trench. This work should be done now so that the land can settle down and be ready for planting about the month of May, which is the commencement of what is known as the planting season. During the interval before planting occasional light hoeing should be done in fine weather to destroy seedling weeds; the land will then be sweet and clean when planting-time arrives. Further, meanwhile the selection of the plants and their arrangement should be given a great deal of consideration, as the use of plants suitable to the locality and tastefully arranged is naturally a matter of first importance.

Old shrubbery borders that lack interest may often be greatly improved by some replacements or additions. Tree ferns and palms may be added to afford variety, and flowering shrubs to provide colour at any season that may be desired. Careful study of local gardens and a visit to the nursery will suggest subjects suitable for either purpose.

—*W. C. Hyde, Horticulturist, Wellington.*

On page 300 of the November, 1933, issue of the *Journal* a statement relative to Webb's Masterpiece occurs. In this instance the swede used was not Webb's Masterpiece.

In a progress report on investigations at the Plant Research Station, Palmerston North, relative to the production of ten varieties of lucerne, nine of which were of overseas origin, it is indicated that Marlborough (New Zealand) type excelled all the others.

A large amount of experimental work has been carried out in recent years, and the result is to show conclusively that the objections to the use of the so-called physiologically acid manures have been the result of misconceptions or possibly even misrepresentations. The use of superphosphate does not generally increase the acidity of the soil.—*Extract from Presidential Address, Agric. Section Brit. Assocn., 1933.*

Sowing down Golf-greens.—In its report on Green-keeping Research the Agrostology Section Plant Research Station says: "A mixture of brown-top and Chewings fescue (one part brown-top to two parts Chewings fescue, at the rate of 1 oz. of the mixture to the square yard) has definitely given the best results to date, and the inclusion of other species in the mixture at present does not seem to be warranted under the conditions of our trials at least. As far as rapid and strong early competitors in the mixture, such as rye-grass and crested dogstail, are concerned, these have definitely shown to be inimical to the establishment and well-being of the finer-leaved grasses. As far as the slower-establishing species in the mixtures are concerned, it is yet too early to give any information regarding these. There is now at the end of twelve months practically no difference between the heavy seeding and the light. It must, however, be borne in mind that the light seeding here is still fairly heavy. From the general swards sown out with 1 oz. of mixture to the square yard, it would appear we can depart very little from this as a standard recommendation. Soil fertility, condition of the seed-bed, weather conditions, even spreading of seed, depredations of birds, &c., all must be taken into account when recommending quantities to sow and heavy applications rather than light should be the rule. The correct fertility standard to set in order to maintain a nice blending of brown-top and Chewings fescue is important. The general thesis at present is that too high manuring plus watering will favour brown-top at the expense of the Chewings and low manuring plus dry conditions will favour Chewings fescue at the expense of the brown-top."

WEATHER RECORDS: JANUARY, 1934.

Dominion Meteorological Office.

NOTES FOR DECEMBER.

PEOPLE generally regarded January as a changeable and unpleasant month. It was cold and windy for midsummer. To the meteorologist, also, the weather was rather abnormal. This was due principally to the unusually pronounced development of the summer monsoon in Australia. In the middle of the month a severe heat spell was experienced there. Air was being poured out from the Continent in a westerly direction and had a pronounced influence on conditions in New Zealand.

Rainfall.—In the North Island the heavy rains of the 28th and 29th brought the total month's fall above the average in coastal areas from Kawhia to the South Taranaki Bight, and in parts of the Hawke's Bay and Wairarapa districts. In the west some of the excesses were large. The remainder of the North Island had less rain than average, very dry conditions being experienced in most of the Auckland Province.

In the South Island there were very heavy rains along the east coast and extending over most of the interior of Canterbury and southern Nelson and Marlborough. Double the average fall was recorded in places. In northern Nelson and the interior of Marlborough, South Canterbury, Otago, and Southland, the situation was reversed, the totals being much below normal.

Temperatures.—The month was abnormally cool. In practically all parts the mean temperature was much below the January average. Particularly was this the case in the Waikato, Taranaki, and Manawatu districts. On the morning of the 23rd there was a rather widespread frost which, though only light, was sufficient at this time of year to do considerable damage to tender crops.

Sunshine was much below normal in the eastern portions of South Canterbury and Otago. Elsewhere there was little departure from the average, but generally it was slightly below.

Pressure Systems.—The first stormy period began on the 2nd, and conditions remained unsettled in the South Island until the 7th. Rain was fairly general in the latter area and there were some very heavy falls in Canterbury. On the 5th they were accompanied by thunderstorms and heavy hail, which did much damage to wheat crops.

The next disturbed period was from the 11th to the 14th, and was caused by a somewhat similar depression to that responsible for the first. Again there were heavy rains with some hail and thunder in parts of Canterbury.

A series of westerly depressions between the 18th and 22nd, though at most places they did not produce much rain, were responsible for some rather unusual and unpleasant phenomena. The depressions were followed by a sharp fall of temperature and on the 23rd, as has already been mentioned, a frost occurred.

The weather again became unsettled after the 23rd. At first, westerly depressions crossing the South Island caused heavy rain in the high levels, especially on the 25th, when there were thunderstorms on the west coast. Elsewhere there was comparatively little rain. At this stage a zone of low pressure lay across the central part of the Dominion, and in the following days it moved very slowly northwards. Though it was not very marked, it was responsible for widespread rains on the 28th and 29th. The disturbance was of a very unusual kind and due to the outpouring in the upper levels of warm air from Australia.

Rainfalls for January, 1934, at Representative Stations.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.	Total for Year to Date.	Average for Year to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	0·21	5	0·11	3·94	0·21	3·94
Russell	1·62	5	0·65	3·25	1·62	3·25
Whangarei	3·41	8	1·95	3·93	3·41	3·93
Auckland	1·57	10	0·59	2·72	1·57	2·72
Hamilton	2·99	9	0·93	3·57	2·99	3·57
Rotorua	2·97	8	0·91	4·26	2·97	4·26
Kawhia	5·45	14	1·78	3·55	5·45	3·55
New Plymouth . .	6·14	18	3·80	4·19	6·14	4·19
Riversdale, Inglewood . .	5·61	19	2·82	7·51	5·61	7·51
Whangamomona . .	2·98	6	1·16	5·58	2·98	5·58
Hawera	3·76	14	1·48	3·51	3·76	3·51
Tairua	0·87	7	0·38	3·66	0·87	3·66
Tauranga	2·08	6	0·61	4·08	2·08	4·08
Maraehako Station, Opotiki	1·40	5	1·06	3·59	1·40	3·59
Gisborne	2·28	8	1·47	2·72	2·28	2·72
Taupo	2·02	7	0·93	3·37	2·02	3·37
Napier	2·93	10	1·10	2·93	2·92	2·93
Hastings	1·99	9	0·84	1·93	1·99	1·93
Whakarara Station . .	. .	. .	. .	. .	. .	. .
Taihape	2·40	13	0·55	3·20	2·40	3·20
Masterton	2·57	8	1·01	2·60	2·57	2·60
Patea	5·30	13	2·28	3·59	5·30	3·59
Wanganui	4·58	11	0·86	2·83	4·58	2·83
Foxton	2·17	7	1·00	2·14	2·17	2·14
Wellington	2·03	13	0·53	2·81	2·03	2·81
South Island.						
Westport	10·30	17	2·28	8·20	10·30	8·20
Greymouth	8·73	16	1·69	9·17	8·73	9·17
Hokitika	8·20	16	1·53	10·07	8·20	10·07
Ross	12·15	13	3·53	12·40	12·15	12·40
Arthur's Pass . .	14·97	12	5·30	14·12	14·97	14·12
Okuru, South Westland	. .	. .	. .	12·59	. .	12·59
Collingwood	3·20	14	0·83	6·71	3·20	6·71
Nelson	0·74	9	0·22	2·81	0·74	2·81
Spring Creek, Blenheim	0·80	5	0·25	2·22	0·80	2·22
Hanmer Springs . .	7·42	10	2·49	3·90	7·42	3·90
Highfield, Waiau . .	5·35	7	3·06	2·98	5·35	2·98
Gore Bay	4·83	10	2·12	2·46	4·83	2·46
Christchurch	3·44	15	0·93	2·18	3·44	2·18
Timaru	7·22	16	1·80	2·27	7·22	2·27
Lambrook Station, Fairlie	4·59	10	1·82	2·43	4·59	2·43
Benmore Station, Clearburn	1·51	12	0·76	2·77	1·51	2·77
Oamaru	3·69	16	0·97	2·04	3·69	2·04
Queenstown	1·17	9	0·37	2·92	1·17	2·92
Clyde	1·68	7	0·59	1·85	1·68	1·85
Dunedin	5·08	13	1·90	3·43	5·08	3·43
Wendon	2·17	9	0·80	3·20	2·17	3·20
Gore	. .	. .	. .	3·08	. .	3·08
Invercargill	3·68	17	0·68	4·01	3·68	4·01
Puysegur Point . .	6·50	21	2·44	7·62	6·50	7·62
Half-moon Bay . .	5·03	24	0·54	4·82	5·03	4·82

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SOME OBSERVATIONS ON CERTIFIED PERENNIAL RYE-GRASS IN CANTERBURY, OTAGO, AND SOUTHLAND.

E. BRUCE LEVY, Agrostologist, Plant Research Station, Department of Agriculture, Palmerston North.

THE first certified perennial rye-grass seed was sown in the South Island in 1929 and since then there has been a steady increase in the acreage sown. At the present time approximately 10,000 acres have been sown and harvested for seed in the South Island under certification, and at a conservative estimate a like acreage has been sown for ordinary grazing purposes. In view of this increasing area a survey of the performance, possibilities, and limitations of the certified strain of perennial rye-grass in the South Island will be of considerable value; moreover, in view of the fact that practically all the stock mother seed for the sowing-down of this area in the South has been grown in Hawke's Bay and Poverty Bay districts, and in view of the prevailing thesis that "home-grown seeds are best," an analysis of the behaviour of the certified type as against locally produced types is of added interest.

FIELD-PLOT TRIALS.

Fifty-eight large field-plot trials of rye-grass types have been laid down in various parts of New Zealand, and these cover not only a full geographical and climatic range, but also a considerable range of varying soil-types.

Trials at the Plant Research Station, Palmerston North, resulted in the adoption of the following classification of commercial perennial rye-grass types:—

- Type 1. New Zealand certified perennial.
- Type 2. British indigenous perennial.
- Type 3. Good false perennial—the best of the South Island types and the best British commercial.
- Type 4. Average false perennial—typical of the general run of South Island perennial and poorer lots of British commercial.
- Type 5. Bad false perennial representative of the worst commercial "perennial" rye-grass offered for sale.
- Type 6. Italian rye-grass sold as perennial rye-grass.

Prior to laying down any of the above fifty-eight field-plot trials, the rye-grass type was determined by trial at Palmerston North, and in very many instances seed actually from the same line of each type was sown at each centre. Throughout these trials also, the same amount of seed and manure per acre was used. The following table shows the relative persistency of the various types at approximately two years after laying down. The figure 100 is a relative figure merely, and is employed to represent the most persistent type in any one experiment.

Location of Experiment	Type 1.	Type 2.	Type 3.	Type 4	Type 5.	Type 6.
North Island ..	100	..	70	57	29	20
South Island ..	100	..	72	55	21	10

The figures in the above table serve to show not only the relative behaviours of the main New Zealand perennial rye-grass types, but also that the behaviour of those types is identical, or almost so, when grown in the South Island as compared with the North Island. The New Zealand certified perennial rye-grass (type 1) is the most persistent perennial rye-grass irrespective of where these trials have been conducted in New Zealand.

General Considerations.

In the launching of a project that has as its objective the replacement of one existing strain of any one grass or clover with another of an entirely different type and from an entirely different source, there is bound to be criticism arising, firstly, out of a deep-seated parochialism, and, secondly, because of a mistaken view that the new strain supplied is suitable for all soils, climates, and management conditions to be met with on farms. The experience of the South Island during the past decade at least in so far as ordinary rye-grass is concerned is based largely on annual types. Such types establish quickly and are highly productive of feed for the first year, and the feed produced is highly palatable and nutritious. In a great many cases, also, where the local strain has been used even though the perennial rye-grass is of a fairly good type the farmer has been using mixtures of strains with or without associate species rather than pure sowings of a pure strain. New Zealand certified perennial rye-grass is relatively a pure strain and it has been sown pure largely for seed-production purposes.

Mixtures versus Pure Swards.

It seems that it can be generally accepted as a world-wide truth that pure sowings of any one species or strains will not make such a good pasture as a mixture of species or strains where wide seasonal differences are apparent in the growth of any two or more species or strains. Another feature in regard to the mixture concept as distinct from the pure-sward concept arises in the ecological fact that unless the pure sown species is thriving well, volunteer species may assert themselves and such volunteer species may produce infinitely more feed than the sown species under the conditions ruling for its growth. Or in the case of a mixture sown, the habitat may be admirably suited for one

or more species in the mixture and unsuited for others. Consequently there will be a rise to dominance of that species in the mixture which is best attuned to the conditions ruling, and this is true irrespective of any high-quality attributes of any particular strain of the species used. It is quite conceivable that in many soil-types volunteer growth will produce more feed than the actual pure species or mixtures sown, and in such a case the use of a short-lived, low competitive strain in comparison with a persistent highly competitive strain will permit of a full volunteer growth asserting itself more quickly in the case of the annual short-lived strain than in the case of the persistent strain. Hence the resultant pasture may be better in the case of the short-lived strain than in the case of the persistent strain, not because of the relative merits of each strain in themselves, but because the one permitted faster ingress of volunteer species than the other. This is very clearly marked in all our trials in relation to strains of rye-grass and white clover. It is true also in relation to cocksfoot and such second-rate pasture grasses as brown-top, Yorkshire fog, sweet vernal, &c. The New Zealand certified rye-grass, owing to its persistent and highly competitive nature, is relatively prejudicial to the establishment, spread, and development of white clover, cocksfoot, brown-top, &c., when compared with the annual short-lived type of rye-grass, and it is manifest that where we are farming on country in a state more suitable to white clover, or cocksfoot, or brown-top than it is to rye-grass, then the slowing-up of the establishment, spread, and development of white clover, or cocksfoot or brown-top may result in a lower producing pasture where certified rye-grass has been used in comparison with the case where short-lived annual rye-grass types have been employed. Thus under grazing one strain of rye-grass may appear better than another not in virtue of its own inherent qualities, but on account of its reaction on the other members of the sward.

Further, in a mixture of species where we are dealing with sown certified, sown non-certified, or with volunteer species, there are seasonal fluctuations in growth of each species or strains in the sward, and we may take it that the most efficient mixtures devised are those where there is a series of peaks of production as a result of the component species or strains coming to their individual production peak at different times. Thus in the case of a mixture of Italian rye-grass, perennial rye-grass, cocksfoot, white clover, and Montgomery red clover, the Italian rye-grass forms the first peak, the perennial rye-grass and white clover the second, cocksfoot and white clover the third, cocksfoot and Montgomery red clover the fourth, and in the autumn again the rye-grass (provided it is a persistent strain) reasserts itself and carries on through the winter and early spring. It is obvious that should one or other of these species be omitted from the mixture, or should it fail to establish, the total seasonal production will be less, and what is produced will be poorly spread throughout the entire growing season. Thus it will be seen pure rye-grass pastures, irrespective of the strain sown, are at a disadvantage in comparison with another strain of rye-grass sown out with cocksfoot, white clover, and Montgomery red clover, and in any comparisons made on the farm between one paddock and another this fact must be carefully borne in mind. For instance, in Canterbury pure sowings of certified perennial rye-grass have been compared with older mixed

FIG. I. RYE-GRASS STRAIN TRIALS IN CANTERBURY ON PROPERTY OF MR. HUNTER MORRIS, WINCHMORE.

Certified perennial rye-grass on the mid left compared with a short-lived South Island "perennial" rye-grass on right Plots three years old.

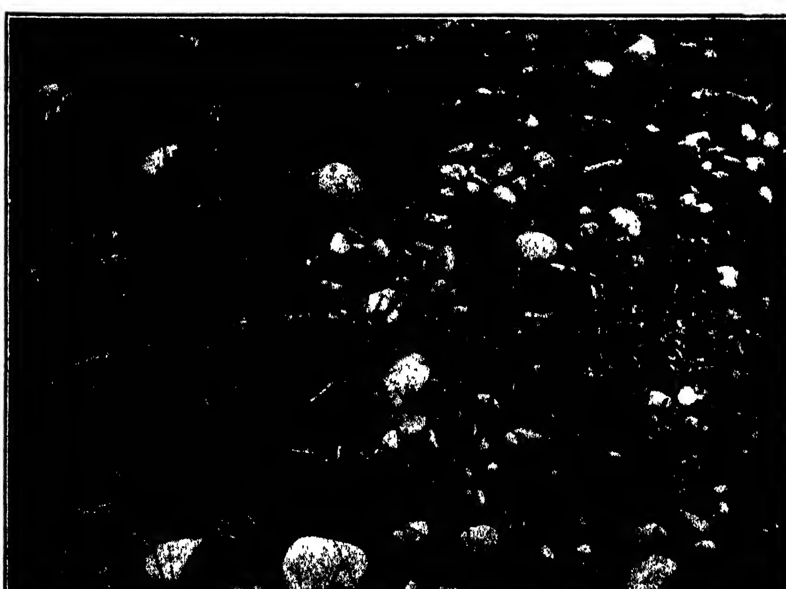

FIG. 2. CLOSE-UP VIEW OF CERTIFIED PERENNIAL RYE-GRASS (LEFT) AND SHORT-LIVED FALSE PERENNIAL TYPE (RIGHT).

Note the ingress of sorrel where the annual type has run out. Plots three years old

[*Photos by E. Bruce Levy.*

pastures of rye-grass, white clover, cocksfoot, &c., and it is only to be expected that the comparison will be unfavourable to the pure sowing made with certified seed.

Swards for Seed-production.

The foregoing remarks apply particularly to pastures laid down for grazing purposes. Where seed-production is the main consideration of the farmer, he must necessarily sacrifice the pasture-sward ideal and aim at a seed-production method that gives the maximum seed crop at the least expense, and for this purpose the pure sward is the best. With somewhat more difficulty attendant harvesting a dual-purpose seeding may be made, and where a seed-grower is also a grazier the dual mixed-seed pasture should be the aim, but in such a crop there is likely to be a smaller seed crop of any one species and a correspondingly greater cost in harvesting. The added value of the pasture for the remaining eight or nine months of the year, however, should more than compensate for the lower seed yields. The point of importance, however, is that seed-production as a business must necessarily sacrifice the ideal of the grazing-pasture sward, and in taking cognizance of the behaviour of certified rye-grass in the South Island this fact must be borne strongly in mind in the notes that follow for the main districts of the South Island.

Position in Canterbury, Marlborough, and Drier Parts of Otago.

Canterbury, North Otago, Marlborough, and the moister parts of Central Otago are relatively the dry areas of the South Island, and the considerations given towards the maintenance of perennial rye-grass, and, for that matter, for truly permanent pastures of first-class species, are somewhat different from those for Southland and South Otago, where the rainfall is always adequate for the full development of these high-production species. The two essentials wherever perennial rye-grass is grown are the building-up of a high standard of soil-fertility and a high per-acre stock concentration to ensure full utilization of the feed produced and to secure as a result of this high per-acre stock concentration two or three dressings per year over the grassed portions of the farm of stock manure containing readily available nitrogen, which is all-essential to the health, vigour, and growth of perennial rye-grass. Perennial rye-grass more than any other species thrives under this hoof treading, and manuring of stock. One has only to recall to mind the night paddock for dairy cows—often stock manured to a wasteful extent—the wool-shed holding-paddock, pig-grazing pens, and those areas of dominant rye-grass through the gateways of paddocks on the farm or on roadways and tracks used as highways for stock. In the trial grounds at Palmerston North it is almost impossible to keep healthy rye-grass in the broadcast sward after the first year unless those areas are grazed by stock.

High per-Acre Stock Concentration Thesis.

Perennial rye-grass then will thrive relatively on the farm according to the stock-carrying capacity of the farm—the higher the stock-carrying capacity of a farm the more and more dominant perennial rye-grass becomes—*i.e.*, provided always the stock are fully

fed and not starved on the area—and, as a corollary to this, the more perennial rye-grass growing well on the farm the higher the stock-carrying capacity. Perennial rye-grass is an almost perfect soil-fertility index within grazed pastures. It is extraordinarily sensitive to rise and fall of available soil-fertility and more particularly in regard to available nitrogen.

This thesis that nitrogen from stock is the most potent factor for the growth and well-being of rye-grass, and, for the matter of that, of most grasses on the farm, would appear to have as its fulfilment a prodigious future in the vast possible maximum stock-carrying capacity of the grassed portions of the farm. It would appear, given a stock concentration of, say, one dairy cow or six to eight ewes per acre as the year round carrying-capacity of the grassed portions of the farm, that sufficient stock nitrogen is excreted by the animals to nourish the grasses as far as the all-essential nitrogen is concerned to

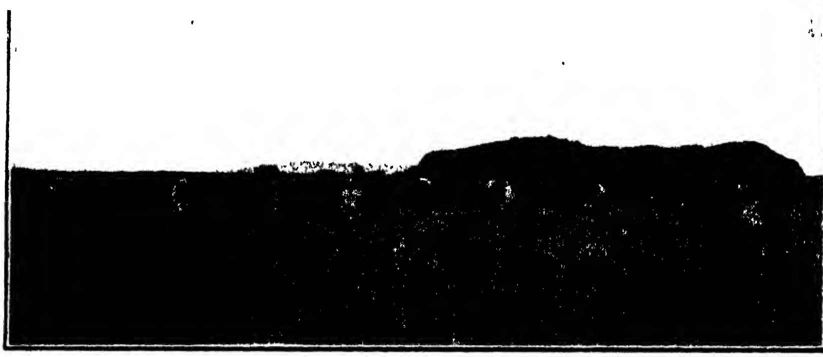

FIG. 3. A HIGH PER-ACRE STOCK CONCENTRATION ON AFTERMATH OF SEED CROP ON PROPERTY OF MR. R. ANDERSON, KAUANA, SOUTHLAND

Twenty-three Timothy seed crops in twenty-five years were taken off this area, and each year the threshed straw was converted into stock-manure by cattle. This stock manuring was largely responsible for healthy state of the pasture and enabled seed crops year after year to be taken

[Photo by E. Bruce Levy

a point where they are producing their maximum, and the maximum possible production from grass will not be secured until the grassed portions of the farm are carrying this high per-acre stock concentration. About this thesis may be postulated, where the possible maximum production of the farm is aimed at, the relationship of (1) area of the farm in grass to that in special supplementary fodders that must be grown in order to provide on the grassed portions this high per-acre stocking; or (2) the amount of artificial fertilizers, where these are effective, that are necessary where hay and silage from grass is the only supplementary crop grown on the farm; or (3) the amount of concentrate feeding in order to carry the stock on grass during the low-production period. The thesis really asserts that unless the grassed portions of the farm are carrying a high per-acre stock concentration, full utilization of the area of the farm is not being made. It asserts that on many farms supplementary cropping,

coupled with more efficient manuring of the remaining grass, should replace a good many acres of the farm now in low-producing grass On hill country the ploughable paddocks should carry more crops, and the more convenient at least of the hill pastures should be top-dressed so that there may gradually come about a higher and higher stock concentration on the grassed portions of the farm.

It will, of course, be obvious that the high per-acre stock concentration thesis has its dangers from the point of view of (1) overstocking in relation to the available stock-foods on the farm, and (2) from the point of view of disease In the former case it must be borne clearly in mind that nothing is more detrimental to the well-being of the sward than close and continuous overgrazing. It reduces production and increases the weed population of the pasture. The high per-acre stock concentration thesis presupposes ample supplies of stock-foods available on the farm to cater for the full requirements of the stock carried. In the case of disease the high per-acre stock concentration thesis does not necessarily presuppose unduly long-duration pastures, but it does presuppose that those pastures should be stocked heavily while they remain down. Stock troubles such as blowing in dairy cattle would be less under a high per-acre stocking than under light stocking, for the reason that there is likely to be a better grass to clover balance in the high stock-carrying portion than in the case of relatively low stock-carrying portions of a good average farm Phosphate or potash manuring under relatively light stocking brings an overabundance of clover, whereas under a high per-acre stocking the additional stock nitrogen grows grass, and particularly rye-grass, rather than clover.

The clover of the sward, however, and more particularly white clover, is the major factor in securing an ultimate high stock concentration per acre where supplementary crops are not extensively grown or where inbrought food-stuffs are not used. Clover in the sward ensures a more profitable exploitation of phosphates, the added growth of the clover through phosphate (or potash) manuring enabling more stock to be held on the farm, which means more waste animal excreta containing quickly available nitrogen that is so essential for the growth and well-being of the grass.

A point also that is worth mentioning in regard to this supply of nitrogen from stock, in seed-producing areas, is the disposal, per medium of stock held on the seeded area, of the threshed straw that at present stands in stacks unconsumed—monuments to the drain of the essential fertility of the soil. It is apparent on farms where an effort has been made to utilize this straw per medium of the animal that there is a marked improvement in the growth of the rye-grass stubble wherever the consumption of such straw by stock has taken place on the area. The rye-grass in the environs of a stack is usually strong and healthy, and this extends outward from the stack, corresponding to the amount of the stack that has been consumed. There is no doubt when stacks are consumed *in situ* there is far too much stock excreta deposited in the immediate neighbourhood of the stack, and if it were practicable to chaff the straw and feed it out in troughs mixed with a little oaten chaff or meal, a much better distribution of the animal excreta would be secured. The greater use of lucerne to provide winter feed in the form of hay for feeding out on the permanently

grassed areas of the farm, or using the grassed areas as run-offs from turnips, rape, &c., would also provide another means of raising the stock-carrying during the winter on the grassed portions of the farm.

The question of how general this practice of feeding out on to grass can become in the drier areas of Canterbury, North Otago, Marlborough, and Central Otago at least, in the writer's opinion, predetermines the area such farmers may have in permanent high-production grassland. High-production perennial pastures are possible only under perennial manuring, and in the drier districts of the South Island there is sufficient rainfall to render available only a small quantity of any artificial manures that may be applied. Hence fertility upbuilding to a perennial rye-grass standard does not seem possible by the use of artificial manures alone. It is possible to raise the soil fertility per medium of soluble stock manure (urine) on soils too dry for artificial manures to become available to the plant, and on the extent of this practice is determined what area of the farm may be laid down to permanent grass. Winter feeding with inbrought food-stuffs—roots, hay, or concentrates—may in many instances pave the way for the ultimate establishment of good perennial pastures that are laid down to certified seeds, and where seed-production is part of the farm routine this practice may be quite justified in the resultant grass-seed crop secured. It must be borne in mind, however, that if hay or chaff containing Italian or false perennial rye-grass is fed on to certified rye-grass paddocks, there is a big danger that these areas will be rejected for certification on account of the Italian or false perennial rye-grass that may become established on the area as a result of the feeding-out.

Artificial Nitrogen.

The use of artificial nitrogen is valuable for seed-production purposes in a season when there is sufficient moisture to make it available. Throughout Canterbury, particularly, autumn stubble manuring with superphosphate and lime, the stubble being well cleaned up in the winter, and a top-dressing at closing-up time with 1 cwt. of sulphate of ammonia per acre, has given good payable seed crops, whereas without such manuring a total failure of the crop could be expected, unless of course the area had been well fertilized by stock nitrogen as outlined above.

Seed-production on Drier Areas.

Because a soil will not grow permanently a true perennial rye-grass this fact need not preclude a seed-grower sowing for seed-production purposes. The "once-growing" of certified mother seed is a possibility on almost any soil in Canterbury, North Otago, and the moister parts of Central Otago despite the small rainfall often experienced. The ameliorating influence of breaking-up and of cultivation frees plant-foods locked up in the soil, and the greatly increased water absorption and water-holding capacities of cultivated and mulched soil, together with the fact that fertilizers applied at time of seeding down are worked deeper into the soil in contact with soil-moisture, all aid materially in the successful growth of the crop during the first year whilst these influences are operative. Hence the production of first harvest seed carries with it little risk of failure to secure a seed crop, and there is the possibility in the drier areas of Canterbury

and North and Central Otago that first-harvest seed-production of certified perennial rye-grass would be a highly payable venture, the area being ploughed over after the crop has been harvested, as one would normally do in taking an annual crop such as wheat, turnips, Italian rye-grass, &c. When the crop is carried on to the second year failure in a dry or non-fertile area will surely result unless some top-dressing and high stock concentration plan as indicated above is put into effect.

Certified Rye-grass of Great Value

Taking Canterbury, North Otago, and the moister parts of Central Otago as a whole, there is ample evidence to convince the writer that certified rye-grass as a major component part in a mixture is a splendid thing wherever pastures over two years are in demand. It will increase the carrying-capacity from 10 per cent. up to 50 per cent. at a very moderate estimate, and will enable the farmer to

FIG. 4. CERTIFIED PERENNIAL RYE-GRASS IN SOUTH CANTERBURY.
Ewes and lambs doing well on property of Mr. S. McKenzie, Timaru.
[Photo by E. Bruce Levy.

draw up his crop-pasture rotation with much more confidence than he has been able to do previously because of the unreliable nature of the commercial rye-grass seed that has been available for his use in the past. As a seed crop it offers to these districts a profitable and secure industry.

It is believed, however, that farmers in Canterbury, North Otago, and Central Otago must themselves decide whether they really want a perennial or an annual as the basis of their grazing pastures. The more arable the farming and the shorter the rotation, the greater is the call for the annual and short-lived species. The less arable the farming and where the effort is to secure a longer pasture phase in the rotation the greater the need of a true perennial, and it is to this latter group—which, after all, is a very large group—that certified strains of perennial rye-grass and other species will come as the greatest boon. There is, however, a small number of farmers, in North Canterbury more particularly, who have maintained a good strain of perennial rye-grass by careful husbandry and who have

perpetuated this strain over a long period of years. The seed of such growers is always in local demand—emphasizing the value of a true perennial to Canterbury itself—and to these people the certified rye-grass means less than to the majority of the South Island who rely entirely on open market seed. Nevertheless there is every indication that certified seed to the South Island as a whole will mean that a greater confidence may be placed in the pasture phase of whatever rotation best fits the peculiar needs of the land.

Position in South Otago and Southland.

It is probably a sound prophecy that certified perennial rye-grass, and certified white clover when supplies of the latter become more readily available, will mean more to Southland and the wetter portions of Otago than to any other district in the South Island. The opportunities for the development of first-class high-production permanent pastures in Southland particularly are enormous. Granted at the moment the production of Southland is high, even with so much poor rye-grass in use and so much run-out pasture in evidence, it but serves to indicate the progress that is possible when a general swing over to certified types of rye-grass and white clover is made. The great asset of these southern districts is the good grassland climate and a plenteous rainfall. Given these two assets, together with cheap artificial manures and good reliable strains of perennial species to form the basis of the sward, then grassland farming is what the farmer likes to make it: he has the moulding of the sward in the hollow of his hands. The building to a high stock concentration in Southland is for the most part highly practicable, and, as cited above, one has only to reach a state of a perennial high per-acre stocking and sward-improvement becomes certain.

Rye-grass Seed-production in Wet Climates

The use of certified perennial rye-grass has received in its initial introduction a serious set-back in Southland owing largely to the fact that this strain produces a seed crop of a low germination capacity when grown for seed in a humid or wet climate. In the production of true perennial rye-grass it would appear, in order to get seed quality—*i.e.*, high germination and seed bulk appearance—that the seed crop must be produced in relatively dry areas rather than in wet, apart altogether from the difficulties of harvesting in a moist or wet climate. It would appear from the researches of E. O. Hyde* that under moist climatic conditions during the development of the grain, fungal injury leads to the death of the germ and consequent reduction in germination capacity of the line, and there is now sufficient evidence to show that the true perennial rye-grass strains are more susceptible to injury by this fungus than Italian rye-grass and false perennial rye-grass, particularly those hybrid lots that have affinities with the Italian parent rather than with the perennial parent. Prior to certification the dominant rye-grass type harvested for seed in Southland was Type 4 and Type 5, hybrid lots that resemble Italian rather than perennial, and that have an exceedingly short life even when grown in Southland. The experience in Southland with three harvests of certified

* *Journal of Agriculture*, May, 1932, pp. 316–319.

rye-grass gives little encouragement at present for the future of Southland as a seed-producing area as far as the true perennial rye-grass is concerned, whether this be the certified type or a good type of perennial rye-grass of Southland origin. It is fairly common knowledge in the seed trade in Southland that old pasture Southland seed does not germinate on the whole as well as does the general run of maiden seed, the vast majority of which is of a bad false perennial type. There is, of course, a possibility that strains of true perennial rye-grass may be produced by selection and breeding which are resistant to this fungal growth ; but, until work along these lines has progressed further, it is obviously too risky in a wet climate like Southland to recommend large-scale seed-production for true perennial rye-grass. Nevertheless, it would appear fairly definite that certified seed even of low-germinating capacity will make an eminently satisfactory pasture if seeding adjustments are made so as to give in the sowing from 20-25 lb. of viable rye-grass seed per acre. There is increasing evidence to show that less seed per acre is required of certified perennial rye-grass than with the ordinary commercial seed, because of the persistency of established plants and their greater tillering habit. In the plot trials at Palmerston North where 40 lb. per acre of all lots of rye-grass are sown, low-germinating lines of certified rye-grass grown in Southland were sown out alongside high-terminating lines of ordinary Southland seed, and in the second year the lines of certified rye-grass, germinating as low as 20 per cent were making better pastures than lines of ordinary Southland germinating 98 per cent. Further, in another trial a 5-lb.-per-acre seeding of a high-germinating line of certified rye-grass gave in the second year a better stand of rye-grass than plots of ordinary Southland sown respectively with 5 lb. 10 lb., 20 lb., 40 lb., 80 lb., 100 lb., and 200 lb. of a high-germinating seed per acre This fact is also true in Southland itself Farmers there have sown their own low-germinating certified seed (as low as 7 per cent. germination) and the pastures are developing so well as to create the impression that the official germination figure given for the line sown does not represent the true field-germination capacity of the seed. The field-plot trials conducted at Palmerston North in connection with certification confirm the Seed-testing Station test in virtually all cases, and when adjustments in quantity are made in the seeding rate normal stands are secured, but a thin strike results corresponding to the Seed-testing Station germination figures if low-germinating lines are not adjusted at time of seeding. As mentioned above, however, thin seedings of the persistent, high-tillering certified strains soon build up to a fairly good sward, so that in the course of time the initial weakness in the sward is to a large extent eliminated. It is noted, however, in field trials that in very low-germinating lines—*i.e.*, as low as 10 per cent., if the line is sown ten times the normal rate frequently the take is too thick. This may be explained from the fact that the figure for low germinating lines is apt to vary between wider margins than in the case of higher germinating lines, largely as a result of the operation of the law of chance in sampling for the germination test, and when adjustments on the average figure are made and when those adjustments are a high multiple, obviously it is easy to sow double the amount of seed in making the adjustment. Thus in a line germinating from 0 to 10 per cent. in the duplicate counts of 100 individual seeds, obviously if this is

adjusted on the average figure—*i.e.*, 5 per cent.—this means the multiple figure is 20. If, on the other hand, the true germination, if enough seeds were taken, were nearer 10 per cent than 5 per cent. this would mean that an overadjustment to the extent of double the seed had been made, and obviously the stand would be thicker than in a normal seeding. Low-germinating seed, however, must be regarded as a serious detriment from the trade point of view, and such seed cannot compete with high-germinating seed from the drier areas of the South Island when it comes to growing the crop for sale outside the bounds of Southland or South Otago itself. There is, however, no reason why Southland should not grow seed of certified rye-grass for its own requirements; but until such time as a high germinating seed may be produced there at comparatively little risk of failure, the writer cannot recommend in the wetter parts of Southland and South Otago rye-grass for seed-production other than for its own requirement. From the grazing point of view, however, Southland should be a large user of certified perennial rye-grass.

Acclimatization Thesis.

There is in Southland to-day a rather prevalent opinion that the germination capacity of certified rye-grass will improve just so soon as the strain becomes acclimatized to Southland conditions. The thesis that "home-grown seeds are best" is at heart based on an ecological concept which may be termed "acclimatization." It seems that the certified rye-grass now being sown in Southland will adapt itself in twenty to thirty years to the climatic and soil conditions of Southland, but I am also of the opinion that when this does take place the strain as a grazing proposition will not be so useful to Southland as will the direct importations from such districts as Hawke's Bay and Poverty Bay. There is no question that the climatic conditions in Hawke's Bay and Poverty Bay permit a longer seasonal growth in a species or strain than will those of Southland, and it would appear from a study of world types that there is bred into a strain when grown under a climatic and soil condition that permits of a long seasonal growth, a long-seasonal-growth characteristic, which characteristic the plant endeavours to reproduce even when placed under somewhat more severe climatic conditions. There is some evidence in Southland, for example, to show that the certified strain of rye-grass is earlier to start growth in the spring and is later to cease growth in the autumn than the present acclimatized strain of perennial rye-grass of Southland itself.

Certified Rye-grass for Grazing.

The fact that seed of a high-germination capacity cannot be relied on has led to bitter disappointment in Southland over certified rye-grass, yet when we consider the vast possibilities in Southland in regard to wool, fat lamb, and dairying, by the general adoption of certified perennial rye-grass, together with certified white clover, as the mainstay of their grazing pastures, it will be realized that the improved grazing pasture, as a result of a more permanent perennial rye-grass, will soon more than compensate for the loss of the perennial rye-grass seed crop, did this happen in its entirety. The estimated

value of the perennial rye-grass seed crop in 1932–33 is £21,886. Southland at present carries, according to the official statistics for the year 1932–33, 2,065,942 sheep with 1,530,535 lambs, 192,170 cattle, of which 81,167 are milking-cows, 23,997 horses, and 14,526 pigs on 1,119,157 acres of sown grass and 125,298 acres of supplementary fodders plus 1,383,000 acres of native tussock plus some grazing from 72,362 acres of grain and pulse crops that may be fed off prior to shutting up to seed, plus a portion of the oat crop of 62,634 acres utilized as grain and chaff.

It is difficult to assess a per-acre stock carrying on the sown grasslands from these figures, but assuming all the stock excepting horses and pigs were carried on the sown grasslands plus supplementary fodder crops plus tussock, then 3,983,229 sheep (1 cattle = 6 sheep and 1 lamb = ½ sheep) are carried on 1,119,157 acres of sown grass

FIG. 5. CERTIFIED PERENNIAL RYE-GRASS IN SOUTHLAND.

Ewes and lambs doing well on property of Mr Wm Hunt, at Titipua. Portion of 1,500 acres in certified perennial rye-grass and good strains of white clover.

[Photo by E. Bruce Levy.

giving a per-acre stocking relative to the sown grasslands of 3·5 sheep per acre. If the thesis of a high per-acre stock concentration is sound, Southland should just double its sheep per acre in relation to the sown grasslands before it can be said that Southland is getting the possible maximum out of the country laid down to sown grass. Whether this be done (1) by increasing the amount of supplementary crops grown that are fed out more on to the sown grassland, (2) by feeding inbrought concentrate foods to stock held on the sown grassland, or (3) by a more universal programme of top-dressing (out of 1,119,157 acres of sown grass only 125,356 acres, or 11·2 per cent., are top-dressed) success will depend on whether a good strain of perennial rye-grass forms the basis of the sward. Certified rye-grass, in the writer's opinion, will make this objective possible, and there is evidence in Southland to-day that the amount of supplementary crops grown will be less than formerly, provided (1) certified perennial strains of grasses and clovers are sown, (2) top-dressing becomes more universal, and (3) that some judgment is shown in regard to

placing the root crops on the farm in such a way that they may be fed in conjunction with the sown grassland so as to transfer as much as possible of the animal residue from the crop consumed on to the sown grassland.

Southland at present grows 1 acre of roots or other supplementary fodders to 9 acres of sown grass. Individual farmers in Southland who have sown certified rye-grass and good strains of white clover and who top-dress regularly can winter well on the sown grass with round about 1 acre of turnips to 18 acres of sown grass. The point at issue, however, is whether top-dressing grass sown to good strains can give the high per-acre stock concentration in Southland more cheaply than can the use of roots or other supplementary crops. No doubt all of the three methods outlined—*i.e.*, (1) top-dressing, (2) growing roots and fodders, and (3) feeding inbrought foodstuffs—will play a part in raising the stock carried per acre of sown grass; and, when this is accomplished, provided good rye-grass strains are used, there will be a gradual building-up of the production from the grassland itself, which must considerably reduce the amount of special crops to be grown The main point, however, is to raise and keep the sown grasslands to a high per-acre stocking. Certified perennial rye-grass will make the project practicable in Southland. The uncertified strains give place to brown-top, sweet vernal, Yorkshire fog, and weeds that are quite incapable of being built up to carry the necessary stock and such pastures do not respond the same to the stock-manuring even though the high stocking be attained by additional supplementary feeding.

There is also in Southland the 1,383,000 acres of tussock to consider. In the above remarks this is regarded as equivalent to so much supplementary feed in relation to the sown grasslands Much of this tussock is ploughable country and hence capable of conversion to good sown grasslands, provided capital is available to break up, to liberally treat with lime and phosphate, and to sow the more expensive certified seeds: 5,208 acres of virgin country was sown to grass in Southland in the year 1932–33.

In the writer's opinion, therefore, not only can the sown grassland be greatly improved in Southland, but the area of this may be considerably extended, and the basis of that improvement and extension is certified perennial rye-grass and certified white clover, plus top-dressing, plus roots, plus plenty of stock.

Conclusion.

Certified perennial rye-grass in the South Island is behaving relative to treatment. In the drier areas of Canterbury and Otago success or failure of certified rye-grass depends on the stock concentration after the first year down. Where one-year stubble crops have been well cleaned up, where top-dressing has been applied, and where inbrought food-stuffs have been fed out, and where the threshed straw has been consumed on the area, the sward is healthy and vigorous and the strain everywhere persistent. Where there has been little or no stocking of the stubble aftermath the growth is scanty, yellow, and stunted, and distinctly unpalatable.

Certified perennial rye-grass in New Zealand at least is not excelled by any other perennial rye-grass, and, if it does not thrive, the fault lies not with the grass, but with its treatment, or with the soil-type on which it is grown. It can be said safely that the farmer may regard certified rye-grass as a means test of his soil-type and his grassland-farming capabilities—the better the soil conditions, the better the management; and the higher the stocking, the better the certified rye-grass grows.

THE FUNGI CAUSING ROTS OF STORED APPLES IN NEW ZEALAND.

R. M BRIEN, Mycological Laboratory, Plant Research Station, Palmerston North.

IN pursuance of investigations carried out by this laboratory into fungus wastage in cool stores, a study has been made during the 1931 and 1932 seasons, of the rots present on apples held in cool stores throughout the Dominion. Specimens were forwarded in case lots by the orchard instructors from cool stores at Auckland, Gisborne, Hastings, Greytown, Nelson, Christchurch, and Dunedin. Specimens from 109 consignments were received at the laboratory. Isolations were made from all rots present on these specimens, and most of the fungi responsible have been identified and studied.

The fungi isolated were: *Penicillium expansum* Thom., *Botrytis cinerea* Pers., *Gloeosporium perennans* Z. et Ch., *Glomerella cingulata* (Stonemn.) Spauld. et v. Schr, *Gloeosporium* sp., *Neofabraea malicorticis* (Cdly.) Jack. *Polyopcus purpureus* var. *verus* Horne, *Polyopeus* sp., *Fusarium lateritium* Nees var. *fructigenum* (strains 1 and 2), *Alternaria tenuis* Nees, *Pleospora* sp., *Isaria felina* (D. C.) Fries var. *pirina* E. and E. March., *Pullularia pullulans* Berkh, *Rhizopus nigricans* Ehr. and *Hormodendrum* sp. Of these *P. expansum*, *B. cinerea*, *G. perennans* (as Delicious spot), *G. cingulata* and *R. nigricans* have been recorded by Cunningham(1) as causing rots on stored pome fruits in New Zealand. With the exception of *G. perennans*, *N. malicorticis* sp. and *Isaria felina*, these fungi have also been isolated by Mrs. Kidd(2) and Miss Hellinger(3), from experimental consignments of New Zealand apples after arrival in England.

INOCULATION EXPERIMENTS.

During the period of cool storage, 1932, inoculations were carried out with these fungi on the varieties Jonathan, Cox's Orange Pippin, Delicious, and Sturmer. Apples secured every two months from time of picking till completion of storage, were inoculated* with spores or mycelium or both spores and mycelium inserted into incisions made with a sterile scalpel. The apples were then placed in moist chambers and kept at a temperature of 10°–15° C. The descriptions given of the lesions produced have been drawn from specimens inoculated thirty to forty days previously.

* Apples free from rots or blemishes were surface sterilized in acidulated mercuric chloride solution (1 grm. $HgCl_2$, 2·5 cc. concentrated HCl, 1 litre water) for five minutes, followed by a wash in boiled water for ten minutes.

Penicillium expansum Thom.—This fungus was present to the extent of 5·6 per cent. (average) in thirty-four consignments, all commercial varieties being infected. It produces (Fig. 1)* a lesion which appears first as a watery, pallid-brown, circular spot with clear-cut margin. This lesion develops rapidly, in a few days spreading through the entire fruit. Numerous coremia form on the surface of the lesion shortly after infection. These are at first pallid-green, later changing to dull blue-green. Inoculation experiments showed that *P. expansum* readily produced decay irrespective of variety or length of storage.

Botrytis cinerea Pers.—An average of 16·83 per cent. infection with this fungus occurred in twenty-eight consignments, all commercial varieties being infected. After inoculation (Fig. 2) an unequal brown area appears around the incision, and rapidly penetrates the entire fruit. The infected area remains firm, but the epidermis is thrown into slight ridges or folds. Ashy-grey fructifications appear only where the epidermis has been broken. *B. cinerea* was found to penetrate tissues of the four varieties irrespective of the length of time they had been held in the cool store.

Gloeosporium perennans Z. et Ch.—The writer(4) has shown that this fungus is the cause of "Delicious spot" in New Zealand. During the course of this investigation an average of 13·9 per cent. infection was secured from seventeen consignments, principally from the varieties Delicious and Sturmer, and to a lesser extent from Rokewood, Statesman, and Washington. Lesions (Fig. 3) are noticeable first as small, slightly depressed, light-brown spots, approximately 2 mm. in diameter. As they enlarge the centres become yellowish-brown, the periphery remaining light-brown Lesions are usually circular in outline, but the size varies considerably, ranging from 2 mm. in diameter to 35 mm. on fruits held in cool store for four or five months. At first infected tissues are firm, but become spongy after keeping for several weeks. Penetration occurs to a maximum depth of 18 mm. On mature lesions acervuli appear. These are formed subepidermally, and after rupturing the epiderm. exude spores in dark-cream, gelatinous tendrils. Inoculations snowed that typical lesions were formed on fruits of the four varieties, irrespective of length of storage.

Gloeosporium sp.—This fungus is identical with cultures isolated at the Imperial Mycological Institute, by Miss Hellinger, from New Zealand apples of the varieties Cox's Orange, Jonathan, and Sturmer, and referred to as *Gloeosporium* "A" in her report(3). In New Zealand it has been isolated only from Delicious apples taken from an Auckland cool store, where it caused approximately 10 per cent. wastage. Lesions produced (Fig. 4) by this fungus are circular in outline, dry, slightly sunken, light-brown at the centre to dark-brown at the periphery, and attain a diameter of 30 mm. Penetration occurs to a depth of 22 mm. The affected tissues are soft and stringy. Fructifications of the fungus are rarely formed on infected fruits. Inoculations produced lesions on all four varieties irrespective of length of storage.

* All photographs were taken by Mr H Drake These show apples thirty days after inoculation.

Glomerella cingulata (Stonemn.) Spauld. et v. Sch.—The conidial stage of this fungus occurs principally on fruit stored in packing-sheds prior to grading and packing, and becomes troublesome in cool stores only towards the latter end of the season. An average of 6·6 per cent. infection was obtained from eight consignments of the varieties Delicious, Sturmer, Statesman, Rokewood, and Spitzenburg. Lesions produced (Fig. 5) first appear as small light-brown spots which gradually increase in size, attaining finally a diameter of 40 mm. to 60 mm. Penetration occurs to a depth of 15 mm. to

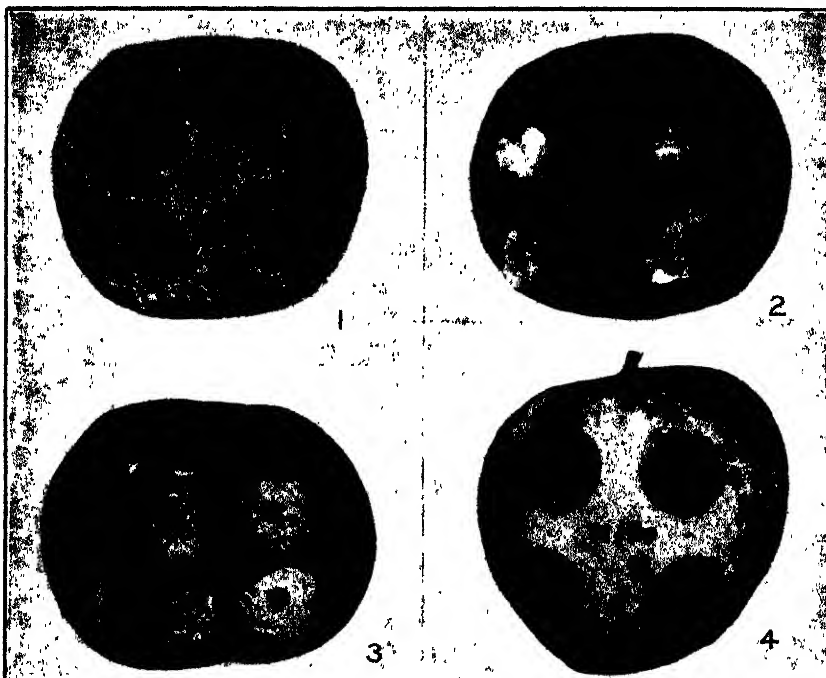

FIG. 1 PENICILLIUM EXPANSUM ON STURMER, SHOWING COREMIA PRODUCED AFTER THIRTY DAYS. FIG. 2. BOTRYTIS CINEREA ON STURMER AFTER THIRTY DAYS. FIG. 3. GLOEOSPORIUM PERENNANS ON JONATHAN FIG 4. GLOEOSPORIUM "A" ON DELICIOUS

25 mm. Lesions usually remain circular in outline, with even margins, their colour changes to dark-brown, and the centres become depressed. They are frequently marked by light and dark-brown concentric zones, which are later obscured by fructifications of the fungus. These appear in the form of acervuli, from which are produced pink, gelatinous spore masses. Lesions were readily produced on the four varieties at all stages in the storage period.

Polyopeus purpureus Horne, var. *verus*.—This fungus was first isolated from consignments of New Zealand apples in 1932 by Miss Hellinger, in England. During the two seasons under review

it was secured from apples taken from several cool stores in the Dominion. An average of 15·1 per cent. infection was obtained from nine consignments, an exception occurring in the case of one lot from Christchurch in which 50 per cent. of the fruit was found to be infected. The fungus is most frequently found on Sturmer, less commonly on Delicious and Jonathan. Lesions produced (Fig. 6) are dark-brown, circular, even in the margin, and 22 mm. to 27 mm. in diameter. The surface is sunken, and the infected tissues firm and rather dry. Penetration occurs to a depth of 15 mm. Fructification are rarely produced on the fruit, although occasionally subepidermal pycnidia, usually sterile, are formed. Inoculations showed that the fungus was only weakly parasitic on the four varieties during the earlier part of the season, but penetrated readily into fruits after they had been held in cool store for four months.

Polyopeus sp.—This species was isolated from fruits taken from two consignments held at Roxburgh, Otago. One consignment (Spitzenburg) showed approximately 8 per cent. infection, the other (Delicious) less than 1 per cent. Cultures were identified at the Imperial Mycological Institute as a species of *Polyopeus*, which did not match exactly any species or variety described by Horne(5). Lesions produced by this fungus (Fig. 7) are usually circular, slightly sunken, black in the centre merging to dark-brown at the periphery, and may attain a diameter of 50 mm. Affected tissues are moist and soft, and penetration may extend to the core. Numerous pycnidia, which are usually sterile, are produced subepidermally. The fungus produced lesions on the four varieties at all periods of storage.

Neofabraea malicorticis (Cdly.) Jack.—This fungus, the cause of north-western apple-tree anthracnose in the United States of America, rarely forms tree cankers in New Zealand, although it is not uncommon on apples held in cool store. An average of 5 per cent. infection was secured from six consignments, consisting of Delicious Sturmer, and Rokewood varieties, taken from cool stores at Nelson and Greytown. Lesions (Fig. 8) are circular in outline, slightly depressed, even in the margin, and may attain a diameter of 30 mm. to 40 mm. The infected tissues become dark-brown, but remain dry and firm. Penetration occurs to a depth of 25 mm. Acervuli are produced in abundance, are arranged in concentric zones, and exude spores in white gelatinous tendrils. Lesions produced by this fungus resemble those produced by *G. perennans*, but differ in that development is less rapid, and lack the yellowish-brown centre peculiar to those caused by the latter organism. Inoculations on the four varieties showed that lesions were formed at all periods of storage.

Fusarium sp.—Two strains of *Fusarium* have been isolated from occasional rotted apples. Both have been identified by the Imperial Mycological Institute as forms of *Fusarium lateritium*, var. *fructigenum*. Strain 1 was isolated from Delicious, Sturmer, and Jonathan, the percentage wastage being less than 1 per cent. Strain 2 was obtained from Delicious, Sturmer, Statesman, and Stayman's Winesap, on which varieties it caused the same percentage wastage. Both strains produce dark-brown, slightly sunken, circular lesions (Fig. 9)

which have regular margins, and which attain a diameter of from 19 mm. to 28 mm. Infected tissues are dry and firm. Penetration occurs to a depth of from 8 mm. to 10 mm. Fructifications of the fungus are not produced on infected fruits. Both strains were feebly parasitic at first on the four varieties (with the exception that strain 2 produced lesions on Jonathan); but pathogenicity increased after fruits had been stored for four months.

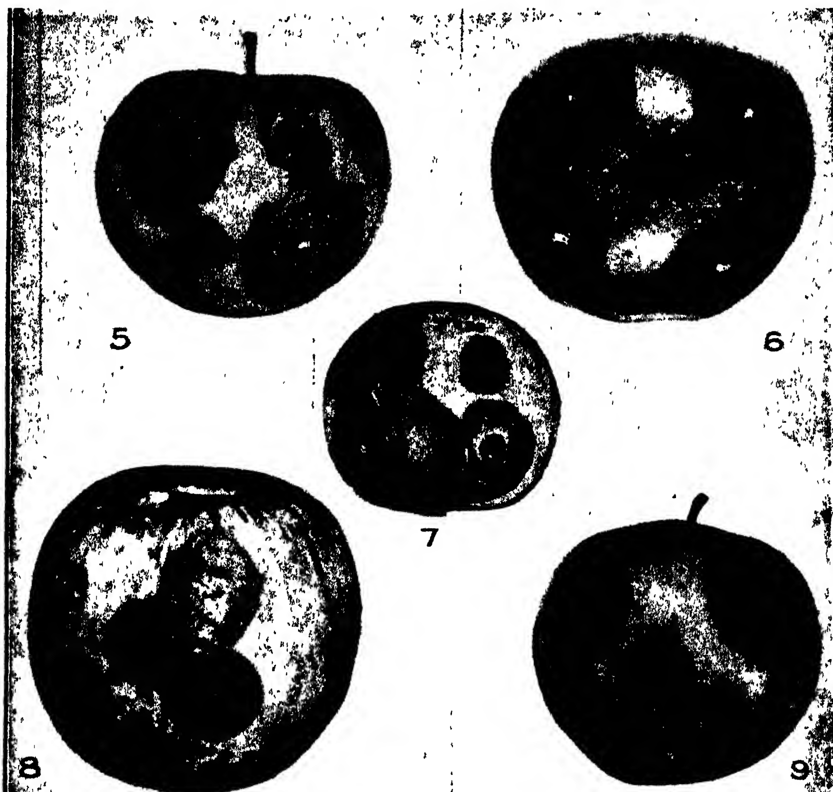

FIG. 5. GLOMERELLA CINGULATA ON STURMER. FIG. 6 POLYOPEUS PURPUREUS ON STURMER FIG. 7. POLYOPEUS SP. ON JONATHAN FIG. 8 NEOFABRAEA MALICORTICIS ON DELICIOUS. FIG 9 FUSARIUM LATERITIUM VAR FRUCTIGENUM (STRAIN 2) ON JONATHAN.

Alternaria tenuis Nees.—Alternaria-rot of apples, although widespread in other apple-growing countries, is rare in the cool stores of the Dominion, as two specimens only have been secured. At cool-storage temperatures *A. tenuis* produces small, dark-brown to black, superficial, dry spots. When inoculated apples are removed to higher temperatures, development is more rapid, and lesions are formed which are black in the centre to dark-brown at the periphery, sunken, circular, and with uneven margins. These may

attain a diameter of 20 mm., penetration being to a depth of 10 mm. Infection was not secured on three of the four varieties. On Jonathans, however, after four months' storage, lesions were produced which attained ultimately a diameter of 20 mm.

The following additional fungi were obtained from apples held in cool stores, but they occurred so rarely as to be of little economic significance :—

(1) *Pullularia pullulans*, following scald on Delicious.
(2) *Pleospora* sp., on Jonathan.
(3) *Rhizopus nigricans*, on Rokewood.
(4) *Hormodendrum* sp., on Spitzenburg.
(5) *Isaria felina* var. *pirina*, on Sturmer.

Additionally several fungi were obtained which remained sterile on all media, and consequently could not be identified.

Methods of Infection.

The fungi discussed usually penetrate through injuries, although in some cases infection was found to have occurred on uninjured fruits The usual points of entry are through injuries produced by stem punctures, insect damage, russeted surfaces, sun scald, spray burns, or branch injuries. Under certain conditions infection may occur by way of the lenticels, *G. perennans* and *P. purpureus* frequently penetrating in this manner.

In the following table is given a summary of the various points of entry on the 1,035 fruits examined during the investigation :—

Entry.	Percentage of Injury.	Type of Injury.
Skin-punctures ..	39·2	Injuries due to stem-punctures, case-injuries, nail scratches, &c
Skin-injuries ..	15·6	Bruises and abrasions due to branch rubs, or careless handling during picking and packing
Calyx entry ..	11·5	Crevices in calyx, open calycine sinus
Stem-end entry ..	18·3	Injuries to stem through faulty picking
Insect punctures ..	11·7	Codling-moth and leaf-roller caterpillar injuries.
Russet	2·2	Frost or spray injury.
Lenticel entry ..	1·5	..

Certain fungi, such as *Sphaeropsis malorum* and *Diaporthe perniciosa*, have been recorded as causing a large percentage of wastage in consignments of New Zealand apples at the time of discharge in England. Mrs. Kidd(2) in 1928 recorded 44 per cent. infection with *S. malorum* on Jonathan, and 70 per cent. on Sturmer, also 40 per cent. infection with *D. perniciosa* on Cox's Orange. Miss Hellinger(3) in 1932 also reported a large percentage wastage due to *S. malorum*. These fungi have not been isolated during this investigation. The former is exceedingly rare in cool store, and the latter has not been collected in the Dominion. This suggests that these fungi either attack fruits on board ship *en route* to England, or in the market after arrival. These factors are significant, and call for further investigations into overseas shipments.

Thanks are due to officers of the Imperial Mycological Institute for identifying many and verifying most of the fungi listed; to the orchard instructors of the Horticulture Division, Department of Agriculture, for procuring specimens from the various cool stores; and to Mr. H. Drake for preparing the photographs.

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TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1933.

W M SINGLETON, Director of the Dairy Division, Wellington

THE position regarding Certificate-of-Record testing in 1933 must be classed as satisfactory, inasmuch as there was an increase in the number of certificates issued as compared with the calendar year 1932. Moreover, the past year was rich in individual performances, several outstanding yields having been authenticated. First-class Certificates-of-Record were issued to 507 cows in 1933, and of this number 461 cows qualified in the yearly-test division and the remaining 46 in the 305-day division. The support accorded the ten-months class continues to indicate that it is favoured by a very small percentage of our breeders, and that its popularity evidences no tendency to increase.

(1) C.O.R. YEARLY TEST DIVISION.

The 461 first-class certificates issued in the yearly division in 1933 represented an average production of 523·10 lb. butterfat per cow, an increase of 22·75 lb. over the 1932 average of 500·35, which was for 443 certificates.

FIRST-CLASS CERTIFICATES ISSUED.

Since the commencement of the C.O.R. system in 1912 8,545 cows have been granted first-class certificates. This number comprises

6,144 Jerseys, 1,679 Friesians, 435 Milking Shorthorns, 216 Ayrshires, 62 Red Polls, 2 Guernseys, and 7 Shorthorns. A numerical summary of yearly certificates issued during the past two years is provided by the following table:—

Table 1.

Breed.	1933.			1932.		
	Ordinary.	Repeat.	Total	Ordinary	Repeat.	Total
Jersey	337	35	372	317	30	347
Friesian	54	15	69	56	15	71
Milking Shorthorn..	11	1	12	16	.	16
Ayrshire	5	.	5	6	..	6
Shorthorn ..	1	..	1	..	..	..
Red Poll . ..	..	2	2	3	..	3
Totals ..	408	53	461	398	45	443

SECOND-CLASS CERTIFICATES ISSUED.

Second-class certificates issued during the year under review numbered 37, as compared with 24 in 1932 Only two breeds were represented, 26 being Jerseys and 9 Friesians. The average production was 486·81 and 551·20 lb fat respectively.

THIRD-CLASS CERTIFICATES.

As explained in last year's review, a class has recently been instituted for cows which qualify for first or second-class C.O.R. in all respects save subsequent calving. It was also stated that, although the class was not intended to be retrospective, the Dairy Division was prepared to issue third-class certificates on past performances on receipt of an application from the owner, and the completion of the necessary statutory declaration as to milk weights, &c. Our records show that during the past year 76 third-class certificates were issued to Jerseys, and 10 to Friesians, one cow in each breed receiving certificates on two separate performances. The average for the Jerseys was 517·83 lb. fat from 9,154·7 lb. milk in 358 days and for the Friesians 685·86 lb. fat from 18,529·1 lb. milk in 365 days. Among the Jerseys was a 1,000 lb. record. Reshure Nova Supreme was credited with 15,440·4 lb. milk, containing 1007·42 lb. fat, in 365 days. It is unfortunate that she did not comply with the calving requirements for ordinary certificate.

PERIOD BETWEEN CALVINGS.

The average period between calving for commencement of test and calving subsequent to test for the 461 cows granted first-class certificates during the year was 403 days, being seven days more

FIG. 1. IVONDALE TINY HEATHER (P. J. PETERSEN, BRIXTON).

Highest C.O.R. Jersey, 1933. Four-year-old Class: 17,419·5 lb. milk, 1,061·3 lb. butterfat.

FIG. 2. GREENCROFT GOLDEN GRACE (J. BONES, KAIPAKI).

New leader junior two-year-old Jersey class: 14,678·4 lb. milk, 864·6 lb. butterfat.

than in 1932. The corresponding period for the second-class cows was 467 days, as compared with 469 days for the preceding year.

Jerseys.

Class Leaders.

One change of class-leadership took place among the Jerseys during the year. This occurred in the junior two-year-olds. In that class Mr. R. Waterhouse's Coniston Goldie, 742·71 lb. fat, gives way to Greencroft Golden Grace, bred and tested by Mr. J. Bones, Kaipaki. This heifer is credited with the particularly fine production of 864·61 lb. fat on a test commenced at 2 years 18 days of age. Another Jersey worthy of special mention is Mr. P. J. Petersen's Ivondale Tiny Heather. She is the tenth cow to gain a first-class C.O.R. on a production exceeding 1,000 lb. fat. On a test commenced at the age of 4 years 273 days Ivondale Tiny Heather yielded 17,419·5 lb. milk, containing 1,061·30 lb. fat. The Jersey class leaders are now as follows:—

Table 2.

Name of Cow and Class	Tested by	Age at Start of Test	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old Greencroft Golden Grace	J. Bones, Kaipaki ..	2 18	277·3	365	14,078·4	864·61
Senior Two-year-old Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,062·2	768·46
Three-year-old Ivondale Silver Rainbow	P. J. Petersen, Waitara	3 327	309·7	365	15,073·4	950·63
Four-year-old Woodlands Felicie	P. J. Petersen, Waitara	4 364	384·9	365	17,332·6	1,220·89
Mature Holly Oak's Annie ..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49

Jersey Class Averages.

Some 372 certificates were issued to Jerseys in the yearly division during the year, their average production of 513·09 lb., representing an increase of no less than 24·78 lb. fat over the preceding year's average of 488·31 fat. It will also be noted from Table 3 that each class showed a distinct increase in average yield. The class averages for 1933 and 1932 are given in the following table:—

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1933.		lb.	lb.
Junior two-year-old ..	150	358	7,868·3	449·63
Senior two-year-old ..	44	356	8,931·5	500·61
Three-year-old	56	358	9,415·3	524·62
Four-year-old	43	354	10,613·7	602·26
Mature	79	358	10,487·8	583·83
	1932.			
Junior two-year-old ..	143	356	7,520·8	430·30
Senior two-year-old ..	33	346	7,916·9	442·51
Three-year-old	56	352	8,995·9	511·96
Four-year-old .. .	41	358	10,188·6	573·61
Mature	74	354	9,880·4	555·68

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system are given in Table 4 :—

Table 4.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old	2,759	347	7,120·1	399·74
Senior two-year-old .	740	345	7,839·9	442·36
Three year-old ..	1,033	344	8,551·3	477·71
Four-year-old	710	347	9,149·9	509·73
Mature	1,695	346	9,481·3	521·40
All	6,937	346	8,194·7	456·88
Average test, 5·57				

Jersey C.O.R. Bulls.

A bull is classed as a C.O.R. bull when he has four or more daughters with first-class certificates, each daughter being from a different dam. The names of 2,294 different sires now appear on our Jersey lists, and of this number 435 have qualified for the C.O.R. class. Champion butterfat bulls total twenty-two. This class is not connected with the Dairy Division, but was inaugurated by the New Zealand Jersey Cattle Breeders' Association, the qualifications being as follows: Each bull must have five or more daughters which under first-class C.O.R. conditions have produced 520 lb. butterfat when starting test up to three years of age, 580 lb. when starting between three and four years old, 640 lb. when starting between four and five years of age, or 700 lb. when five years old or over. As the class was originally constituted, it was necessary that each daughter should be from a different dam, but this qualification has recently been withdrawn. (The corresponding standards for cows in the 305-day test are 460 lb., 510 lb., 560 lb., and 620 lb. butterfat respectively.)

Friesians.

Class Leaders.

There is only one change to record in the Friesian class leaders. In the Junior four-year-olds Westmere Princess Pietertje, whose record of 939·78 lb. fat was made in 1918, yields her place to the Piri

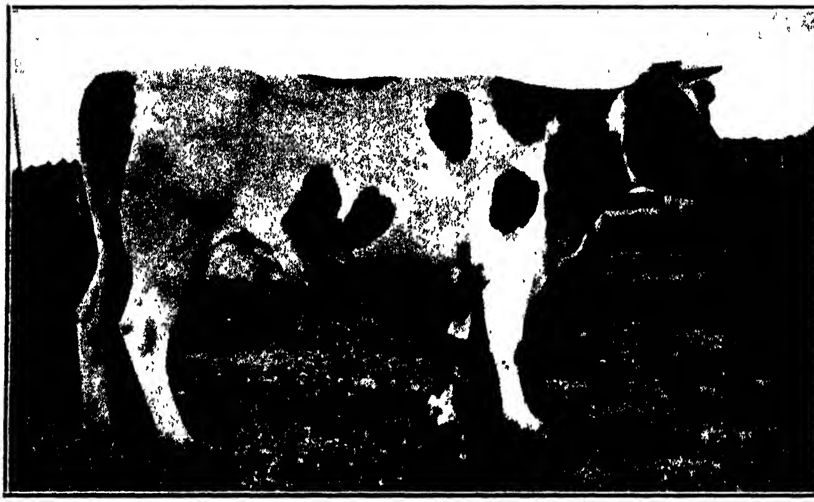


FIG. 3 TOTARA VEEMAN LULU (PIRI LAND CO., AUCKLAND).
New leader junior four-year-old Friesian class 22,364·2 lb milk, 946·78 lb butterfat

Land Co.'s Totara Veeman Lulu, who has gained a certificate for 946·78 lb. fat. The Friesian class leaders are now as follows:-

Table 5.

Name of Cow and Class	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Butter-fat.
		Yrs dys.	lb.		lb.	lb.
Junior Two-year-old. Monavale Queen Bess	T H Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old Pareora Echo Blossom	T Sheriff, Clandeboye	2 223	262·8	365	22,671·9	819·81
Junior Three-year-old Monavale Queen Bess	T H Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old. Totara C R. Buttercup	Piri Land Co., Auckland	3 247	336·7	365	25,885·3	989·10
Junior Four-year-old. Totara Veeman Lulu	Piri Land Co., Auckland	4 12	349·7	365	22,364·2	946·78
Senior Four-year-old. Totara C.R. Buttercup	Piri Land Co., Auckland	4 267	375·2	365	27,108·1	1,079·14
Mature. Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class Averages.

Certificates were issued to 69 Friesians in the yearly division in 1933, their average production being 589·01 lb. fat, an increase of 5·4 lb. over the preceding year's average of 583·61 lb. butterfat for 71 cows. The Friesian class averages for 1933 and 1932 are as follows :—

Table 6.

Class.	Number of Cows.	Average Yield for Season. Days in Milk.	Milk.	Butterfat.
	1933		lb.	lb.
Junior two-year-old	25	361	13,721·3	490·50
Senior two-year-old	6	365	15,966·9	582·18
Junior three-year-old	2	365	18,415·5	679·73
Senior three-year-old	3	364	18,073·1	618·51
Junior four-year-old	7	356	18,133·7	674·97
Senior four-year-old	4	365	18,150·5	687·85
Mature ..	22	351	18,127·1	645·24
	1932			
Junior two-year-old	30	360	13,390·8	495·31
Senior two-year-old	4	365	15,928·8	592·83
Junior three-year-old	3	364	11,932·1	463·79
Senior three-year-old	4	365	18,365·2	718·24
Junior four-year-old	7	362	17,287·2	611·12
Senior four-year-old	4	365	22,419·6	812·16
Mature ..	19	360	17,901·8	653·43

The averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R. system are given in the following table :—

Table 7.

Class.	Number of Certificates.	Average Yield for Season. Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old	624	340	11,855·0	421·35
Senior two-year-old	257	347	12,716·1	452·19
Junior three-year-old	184	342	13,397·2	471·35
Senior three-year-old	186	337	14,008·2	502·20
Junior four-year-old	130	345	15,262·0	541·10
Senior four-year-old	128	347	16,142·4	565·49
Mature ..	565	342	16,024·9	563·15
All .. Average test, 3·53	2,074	344	13,905·7	491·89

Friesian C.O.R. Bulls.

These now number 115, some 5 new names having been added during the year under review. A total of 607 sires are represented in the 1,695 Friesian cows (including the 305-day Division) certificated to the end of 1933.

Milking Shorthorns.

Class Leaders.

The outstanding performance of the year so far as the Milking Shorthorns are concerned was that of Ashley Bank Winsome, owned by Messrs. Peach Bros., of Sefton. Commencing test at the age of 4 years 298 days, this cow gained a certificate for 730·93 lb., and assumes the leadership of the senior four-year-olds in place of Messrs. Ranstead Bros. Matangi Ruth 2nd, 644·90 lb. fat. The Milking Shorthorn class leaders are now as appears in Table 8 on opposite page.

FIG. 4. ASHLEY BANK WINSOME (PEACH BROS., SEFTON).

New leader senior four-year-old Milking Shorthorn class: 17,687·7 lb. milk, 730·93 lb. butterfat.

Milking Shorthorn Class Averages.

Twelve Milking Shorthorn cows gained certificates in 1933, their average production being 502·79 lb. fat from 11,644·3 lb. milk in an average lactation of 351 days.

Table 8.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Matangi Quality 5th	Ranstead Bros., Matangi	2 204	260·9	365	11,752·8	542·66
Junior Three-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old						
Matangi Rugh 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old						
Matangi Matilda 4th	Hon Mrs E J Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Senior Four-year-old.						
Ashley Bank Winsome	Peach Bros , Sefton	4 298	378·3	365	17,687·7	730·93
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

The averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 are given in the following table :—

Table 9.

Class.	Number of Certificates.	Average Yield for Season		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old* ..	54	348	8,360·9	343·32
Senior two-year old .	40	349	8,855·0	366·44
Junior three-year-old* ..	25	336	9,751·7	392·95
Senior three-year-old ..	30	343	10,772·2	447·39
Junior four-year-old ..	24	349	11,091·1	447·78
Senior four-year-old ..	32	342	11,609·4	461·21
Mature	272	341	11,769·8	471·56
Total .. .. Average test, 4·03	477	343	10,926·0	440·70

* No additions in 1933

Milking Shorthorn C.O.R. Bulls.

No new names were added during the year to the list of Milking Shorthorn C.O.R. bulls, the total therefore remaining at fourteen. The 435 cows of this breed certificated to the end of 1933 were sired by 146 different bulls.

Ayrshire.

Five Ayrshire cows qualified for first-class C.O.R. in 1933, their average yield being 429·78 lb. from 10,454·3 lb. milk in 360 days. It should be mentioned that all five were in the two-year-old class. There were no changes in class leaders, the list remaining as follows :—

Table 10.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season. Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Maesgwyn Victoria .	C. Morgan Williams, Kaiapoi	3 250	302·0	365	16,507·7	640·98
Four-year-old.						
Ivanhoe Fancy	A. M Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Floss of Braeside .	W. Moore, Homebush	7 287	350·0	365	20,305·5	832·72

Ayrshire Class Averages.

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 are supplied by the following table :—

Table 11.

Class	Number of Certificates.	Average Yield for Season. Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	68	346	9,005·0	373·54
Three-year-old*	38	347	10,043·0	414·16
Four-year-old*	27	346	11,378·0	459·52
Mature*	109	348	11,905·5	484·54
Total .. .. Average test, 4·09.	242	347	10,739·2	439·51

* No additions in 1933.

Ayrshire C.O.R. Bulls.

No further Ayrshire bulls qualified for the C.O.R. class during the year, the total to date remaining at eleven. Some 124 sires are represented in the 216 Ayrshire cows certificated to the close of 1933.

Red Polls.

Only two Red Polls qualified for certificate during the year, one in the four-year-old and the other in the mature class. The average

production was 485·89 lb. butterfat from 11,608·8 lb. milk in 365 days. Neither of these performances affected the class leadership, particulars being as follows :—

Table 12.

Name of Cow or Class.	Tested by	Age at Start of Test.	Fat required for Certificate	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Wayward 6th B No 1	G S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old						
Dominion Gold Top	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	450·46
Four-year-old.						
Wayward 6th B No. 1	G. S Young, West Plains	4 297	343·2	365	13,290·0	580·05
Mature.						
Waihou Pip ..	W. Jackson, Waihou	7 25	385·0	365	12,681·8	537·90

Red Poll Class Averages.

The averages, class by class, for all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 are as follows :—

Table 13

Class	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old*	39	345	7,016·4	338·15
Three-year-old* .. .	14	348	8,004·4	350·45
Four-year-old . .	7	346	10,032·8	429·80
Mature	24	339	10,577·4	443·91
All	84	344	8,728·4	378·05
Average test, 4·33				

* No additions in 1933.

Red Poll C.O.R. Bulls.

The sixty-three Red Poll cows (including one in the 305-day division) certificated to date represent twenty-five different sires, four of which have now qualified for the C.O.R. class. Certificates gained during the year did not alter the bull list for this breed, for the reason that two of the cows had already received certificates on earlier records and the third cow was sired by a bull already on the list.

(2) C.O.R. 305-DAY TEST DIVISION.

As previously stated only 46 first-class 305-day certificates were issued in 1933. Of these 39 went to Jerseys, 6 to Friesians, and one to a Red Poll. In addition a second-class C.O.R. was gained by a Jersey cow which failed by nine days to calve within the 395 days as required by the rules governing the system.

Jerseys.

Class Leaders.

Five classes are recognized in the Jersey breed and four of the previous class-leadership records were broken during the year the mature class alone remaining unchanged. The class leaders are now as follows :—

Table 14.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Erinview Empress ..	J. Murray, Woodville	2 70	257·5	305	9,163·2	523·99
Senior Two-year-old.						
Erinview Joan ..	J. Murray, Woodville	2 339	284·4	305	10,130·1	607·08
Three-year-old.						
Glendale Silver ..	A. Montgomerie, Kauwhata	3 319	318·9	305	11,352·7	631·42
Four-year-old.						
Montrose Leonie ..	V. J. Williams, Pukekohe	4 316	355·1	304	10,041·1	560·29
Mature.						
Perfection's Hopeful	J. A. Mitchell, Longburn	5 339	360·0	305	11,090·7	664·51

Jersey Class Averages.

The production averages, according to age class, of the 39 first-class certificates issued to cows of the Jersey breed during the year under review are given in Table 15. The average for all the cows was 450·96 lb. butterfat, and the average test 5·57 per cent.

Table 15

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1933.		lb.	lb.
Junior two-year-old ..	15	301	7,067·3	395·35
Senior two-year-old ..	4	305	8,720·2	499·97
Three-year-old	7	297	8,230·4	462·56
Four-year-old	4	279	8,565·2	478·10
Mature	9	301	9,204·5	500·79

Friesians.

Class Leaders.

One change took place in the Friesian 305-day division during the year, this being in the mature class. There were previously two blanks in the list no cows having been entered in either the junior three-year-old or junior four-year-old class. Paepaetahi Isobel being the only cow yet entered in the junior three-year-old automatically

assumes leadership of the class, but the junior four-year-olds still remain without a representative. The class leaders are now as follows:—

Table 16.

Name of Cows and Class.	Tested by	Age at Start of Test.		Fat required for Certificate.	Yield for Season.		
					Days.	Milk	Butter-fat
		Yrs	dys	lb.		lb	lb
Junior Two-year-old.							
Waterloo Queen Helen Beets	R. S Tuck, jun, Waharoa	2	4	250·9	305	11,585·50	425·48
Senior Two-year-old.							
Rosevale Beauty Posch Griselda	E. H Watson, Windsor	2	216	272·1	305	12,273·50	468·50
Junior Three-year-old.							
Paepaetahi Isobel ..	A F. Perkins, Taradale	3	20	289·0	292	10,020·00	461·67
Senior Three-year-old.							
Sealands Alcartra Fobes	H G A Cameron, Weraroa	3	304	317·4	305	10,407·80	389·04
Junior Four-year-old	..	..		..	..	..	.
Senior Four-year-old							
Ellerlea Aaggie Segis Minto	C. H. Steadman, Pokapu	4	357	359·2	305	15,311·90	557·71
Mature.							
Ellerlea Egie Segis Minto	C H Steadman, Pokapu	6	345	360·0	305	16,303·10	650·85

Friesian Class Averages

The average production of the 6 Friesians gaining certificates during the year was 438·31 lb. fat from 11,182·6 lb. milk in 293 days, the average test being 3·91 per cent. One cow was in the junior two-year-old class, two in the senior two-year-old class, one in the junior three-year-old class, and two in the mature class.

We desire to again record our appreciation for the courtesy and assistance of the secretaries of the various breeders' associations whose breeds participate in the testing.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 25th January to 22nd February, 1934, include the following of agricultural interest:—

No. 69357: Drive for shearing-machines; D. G Sloan and J S Cowcher. No. 69496. Hay-rake; H. R. Saunders. No. 70382 Animal medicine, C O. Saunders. No. 70767. Blending butter; J. O'Connell and H H. Kerr. No. 71319. Cream delivering; H. G. Sectrine. No. 70513: Wire-fencing tool F A. Price. No. 70910: Scouring of milking-machine; J. F Roberts No 71149: Churn; W. M. McCorkindale. No. 71348: Harrow; H. Thomas No. 70126: Castrating instrument; A. Clark.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

PULLING OUT WOOL FIBRES AND ITS EFFECT ON HAIRINESS.

K. M RUDALL, National Research Scholar, Massey Agricultural College, Palmerston North

IN experiments on the effects of shearing, new hairy fibres were frequently found where there was reason to believe that the original fibres had been pulled out of their follicles. It was also clear that where the animal was comparatively non-hairy the new fibres showed far less hairiness than in the case of hairy animals(1). These observations have been followed up with further experiments, and the results are given below.

Recent work on wool, as well as on many other animal characters of agricultural interest, has emphasized the importance of considering the underlying physiological potentialities upon which depends the maximum possible development of both structures and functions. Methods of measuring or recording these physiological potentialities are much to be desired, for such observations as we can make on the completed structure or on the functional activity of a part may give a very unfair indication of the underlying hereditary tendency. This is due to the complex interaction of genetic and environmental factors, which combine to produce great variations in the structure or in the function of a part. While we eagerly follow the many variations that appear in the yearly growth of wool, we may tend to forget that in a given animal many of these variations are due to different environmental causes acting on certain more or less constant tendencies. Thus one animal showing more hairiness than another may actually possess, if the two are compared under standard conditions, less, equal, or greater keratinizing ability. The purpose of the present work is to describe experiments on pulling out fibres by their roots (epilation), and to compare the regenerated fibres with those which they are succeeding. It is hoped that these observations on epilation will throw some light on the innate potentialities upon which the degree of hairiness depends, and perhaps, in addition help in the elucidation of problems connected with fibre growth in general.

In higher vertebrates regeneration is most frequently met with in epidermal structures. Such examples as the growth of a new crop of feathers in birds plucked between moults, and the growth of a new coat in mammals after epilation are common knowledge. With reference to mammalian hair, Heusinger (1822) worked on the vibrissæ (or whiskers) of dogs and showed that even five days after the fibres were pulled out the new hair had become established. Vaillant (1861) on the guinea-pig found that the reappearance of hair at the skin level took place eight to twenty days after pulling, while the actual regeneration commenced before the fourth day. Giovannini (1890)(2) made some very detailed and complete studies on the regeneration of hair pulled from the human head. The results are somewhat surprising in that no regeneration occurred till forty-one days after epilation. General conclusions from observations on regeneration indicate that the new structure is nearly identical with the old and is formed in a manner apparently identical with the embryonic development. Wool, however,

must be looked upon not merely as a structure, but as the record of a continuous physiological process which is very much influenced by the interplay of genetic and environmental factors. These combine to produce such a large amount of variation along the length of the single fibre that it is quite obscure as to what part of the original record of growth will be most resembled by the record shown in the fibres following regeneration. The observations made in this paper refer very largely to curly-tip hairiness, which is often to be seen extending for a longer or shorter time after birth. Where the duration is longer there is very often a cessation or reduction of hairiness setting in about the time when the last of the birthcoat kemps complete their growth. This period, when fibres either cease or just maintain their growth, is referred to as the "crisis" or "crisis period," and occurs about the third month(3). How the extent and coarseness of the medullation in the regenerated wool compares with the pre-crisis hairiness is described below.

The Experiments.

Approximately one hundred samples of wool were pulled out of their follicles, the animals experimented with being crossbred lambs and hoggets of Romney type. Twenty such samples were pulled in the lamb stage during midsummer, while the remaining samples were pulled in midwinter. At least three samples were pulled from each animal, but sometimes five samples were taken. Regions sampled were the britch, side, back, foreleg, and shoulder, while the areas sampled were circular and never more than ¾ in. in diameter.

(a) Examination of Animals showing a Considerably Hairy Tip in the Lamb's Coat.

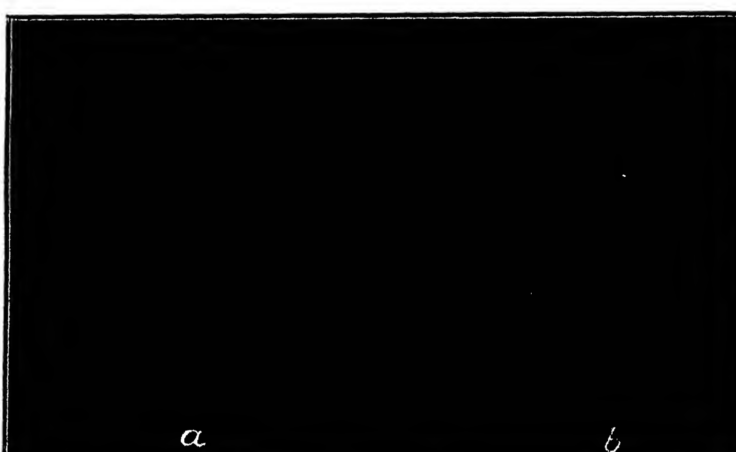
In each case britch, back, and foreleg were pulled in midsummer. Hairy-tipped fibres replaced the original, and the new growth was either as coarsely medullated as or more coarsely medullated than the lamb's coat. Where the hairiness in the fleece of the lamb ceased or was reduced well before the crisis-level, the hairiness following pulling was not well sustained, but following a fleece wherein medulla ceased or was reduced at or near the crisis-level the hairiness following upon pulling generally lasted some three or four months. (Fig. 1.) Thus after epilation the medullation is also comparable in extent with that in the lamb's coat. The medulla-producing effect of pulling is a definitely local one. Numerous samples were examined from regions adjacent to pulled staples, but these were quite unaffected.

In midwinter other fibres were pulled on the same animals in the hogget stage. The hairiness of the new fibres exceeded, equalled, or was less than that of the lamb's fleece. In cases where there was a reduction in the amount of medulla produced by pulling, this reduction might be seen at one part of the body and not at another. In certain lambs, which were nearly equally hairy at back and side, there was a great difference in the amount of medulla produced at these points following shearing. After pulling out fibres on these animals it was found that in the regenerated wool the back was either much reduced relative to the side or both regions had been reduced relative to the lamb's coat. Hence there is some reason to believe that the reduced hairiness following pulling is due to an improvement in the keratinizing power. On the

FIG 1 PHOTOGRAPH OF WOOL SPECIMENS IN BENZOL

(*a*) The coat of a lamb showing reduction in hairiness about the crisis-level

(*b*) After pulling the wool in mid-winter from the same position as (*a*) Hairiness is maintained for several months, being closely comparable with that in the lamb's coat



PHOTOGRAPH OF WOOL SPECIMENS IN BENZOL

(*a*) The coat of a lamb which grew very badly. Thin medulla is shown for a short time after birth while at the base of the sample a very little medulla has come in again

(*b*) After pulling the wool in mid-winter from the same position as (*a*). Hairiness is well sustained in the regenerated growth.

other hand, a suppressing effect due to winter conditions must be considered, and it remains to be seen from the results of pulling in summer, during the two-tooth stage, whether there is evidence of such an effect.

(b) Examination of Animals that showed Very Little Hairiness in the Lamb's Coat, but nevertheless became Hairy about the Fourth Month or Following Shearing.

In such cases, as a result of pulling, the regenerated fibres were distinctly hairy, while this hairiness generally lasted for several months. (Fig. 2 (*b*).) Such examples came into the following two classes. The absence of hairiness in the coat of the lamb was in some cases due to infilling or collapse of the medulla(7), while in a further instance (Fig. 2 (*a*)) the condition closely corresponded to cases already described by Dry(3). In certain of his lambs, which had grown badly, medulla appeared in the usual way immediately after birth, but was of very short duration, ceasing well before the crisis-level and was not revived until the third or fourth month.

(c) Examination of Animals showing Little or No Hairiness in the Lamb's Coat, this being the only Hairiness to appear whether shorn or unshorn.

In most cases a very thin medulla appeared after pulling, but was often much delayed. Such hairiness equals in coarseness those traces in the tips of the fleece and lasts for but a short time. Quite often the hairiness in the regenerated fibres is noticeably coarser and more extensive than anything in the lamb's coat, suggesting that with regeneration the latent tendencies to produce medulla are expressed vigorously.

Those animals which showed an increase in the amount of hairiness following pulling as compared with the lamb's coat (Fig. 3) were subjected to a more detailed examination. The condition as to the fibre-type array(4) at back and side was investigated and a brief summary of observations is given in the following table :--

Number.	The Fibre-type Array in the Coat of the Lamb.	Hairiness in Regenerated Wool, following pulling.
720 (side)	Fine big-ended sickle-fibres. very gradual rise in later sickles with fine medullation in early curly-tip fibres (*Ravine array*)	As examined in benzol with naked eye the samples are slightly more hairy after pulling.
624 (back)	Persistent finely medullated sickles; fine checked sickles; fine checked early curly-tip fibres, coarser but non-medullated later curly-tip fibres (*Valley array*)	More hairy after pulling than in the lamb's coat. Finer medulla than at the side.
624 (side)	Shed sickles present (fig. 3 (*a*)). Persistent medullated sickles; fine checked sickles; fine checked curly-tip fibres with a rise to coarser curly-tip fibres showing a little medullation. (*Valley array*)	More hairy after pulling than in the lamb's coat 3 (*b*)
853 (side)	Shed sickles present; persistent medullated sickles; fine checked sickles, fine checked curly-tip fibres with a rise to coarser curly-tip fibres of which an odd one or two are medullated. (*Valley array*)	After pulling there is a distinct band of hairiness which lasts for about one month.
666 (side)	Number of persistent medullated sickle-fibres = 10. Number of sickle-fibres with medullated sickle portion = 25. Number of non-medullated sickle fibres = 35. Number of curly-tip fibres and later fibres = 580 The fibre-type array is a broad *ravine* with no rise to hairiness in the curly-tip fibres. Total number of medullated fibres = 35. Total number of sickle fibres = 70.	A large number of the regenerated fibres following the pulling of this staple were counted as follows:— Number of more coarsely medullated fibres = 7. Number of fibres which can be selected as medullated by naked eye examination in benzol = 43. Number of curly-tip and later fibres = 420. Then expressed per 580 fibres the total number of medullated fibres = 60.

The conditions obtaining in the above samples of wool are (*a*) the existence of a fairly powerful prenatal check ; and (*b*) the drive towards hairiness is fairly vigorous, but extends only weakly into the curly-tip portion of the array. The case of No. 669 (side) is noteworthy where it appears possible that it is the sickle portion of the array that has become medullated as a result of pulling. One may consider that evidence has been brought forward that as a result of the prenatal check the appearance is given of a lesser inherent drive towards hairiness than is really the case, and that the checked fibre may be looked upon as a potential source of hairiness.

It is questionable whether it is the act of pulling that should be considered as the stimulus to the production of medulla. Alternatively, one might consider the new hairiness as dependent upon the nature of the regeneration process, and not on the external mechanical effect

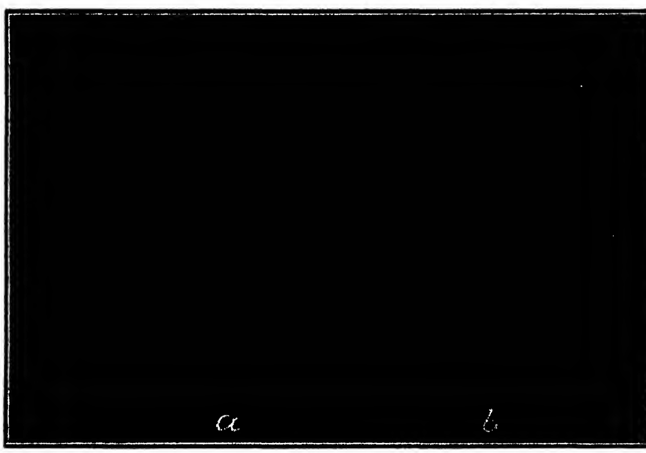


FIG. 3. PHOTOGRAPH OF WOOL SPECIMENS IN BENZOL.

(*a*) The coat of a lamb wherein there has been a powerful prenatal check. The conspicuous hairy fibres are shed sickle fibres.

(*b*) After pulling the wool in mid-winter from the same position as (*a*). The regenerated growth is more evenly and extensively medullated than in the lamb's coat.

of pulling. This view is also supported by the similarity in duration of the lamb's coat hairiness and the regenerated hairiness, both of which are most likely directed by factors for medulla production which become expressed as a result of the new start that the fibre is making. It is hoped to throw further light on this matter by epilating with injections of thallium acetate, and experiments with this have been performed.

In the sheep regeneration following pulling commences almost immediately from the old papilla, the growth of the inner root sheath and the new pointed fibre tip being established by the fifth day, while the foremost fibres reach the skin-level about the fourteenth day. The study of successional fibres of birthcoat kemps in the Romney indicates that the new fibres are variable, being either coarsely hairy, only slightly hairy or even non-hairy(3). Furthermore, there is abundant

evidence from the work of Duerden(5) and Roberts(6) that following shed kemps persistent wool fibres may arise. Various histological preparations of skin were made, and from an examination of these it appears likely that the difference between the new fibres after pulling and after normal shedding may be associated with the greater changes (or degree of atrophy) that occur in the bulb of the follicle following normal shedding as compared with the happenings following pulling where the old papilla is directly the source of the new fibre.

The New Fibre Tips after Pulling.

In a sample of the regenerated wool three types of fibre tip are met with. By far the most common are the tapering pointed tips characteristic of newly arising fibres. Such pointed tips are formed when the inner root sheath has been dislodged. With the formation of new root sheaths new tapering fibre tips appear. But a variable percentage of blunt tips is to be found. Some of these are merely fibres that have been broken off more or less at the level of the skin, while others have been broken at some level between the tip of the papilla and the point at which the fibre frees itself from contact with the inner root-sheath. These latter tips are frequently club-like, and they present a smoky appearance due to air inclusions among the cortical cells (Fig. 5), while almost invariably there is a further smoky swelling a little distance behind the distal end (Figs. 4 (*a*) and (*b*)). These broken fibres, however, behave very differently from the completely pulled fibres and either remain non-medullated or show just a trace of medulla. Very similar fibres are commonly produced by tugging the wool.

Many of the newly arising fibres possess the whip-lash tip that has been described by Duerden and Wildman in the embryo (Fig. 4 (*b*)). Such a tip is formed by the bending-over of the slender point while it is being thrust through the mouth of the follicle by growth from below. A very small percentage of the new pointed fibres show a smoky swelling some little distance from the distal tip, the fibres being normal in other respects. Following pulling it is quite common to encounter sickle-like ends which correspond closely to that form upon which the sickle-fibre type is based. But it is worthy of note that none of these sickle tips show the neck thinning which is believed to be the expression of a definite prenatal check(3).

The Effect of tugging or mishandling Wool, without pulling it completely from its Roots.

Wool fibres broken off at the surface of the skin during epilation frequently became smoky(7) shortly afterwards, while fibres on areas adjacent to the pulled regions did not possess this feature. Staples of wool which were purposely tugged showed, in some of the fibres, this same accumulation of air spaces within the fibre cortex, the spaces being elongated in form and lying parallel to the fibre length (Fig. 4 (*c*)). Such smokiness has been found in the fleece extending as a very distinct band across the length of a staple, while neighbouring staples were free from smokiness—a fact strongly suggesting that the wool under consideration had been mishandled (Fig. 6). Simple trials of the tensile strength of smoky fibres indicates that they are greatly

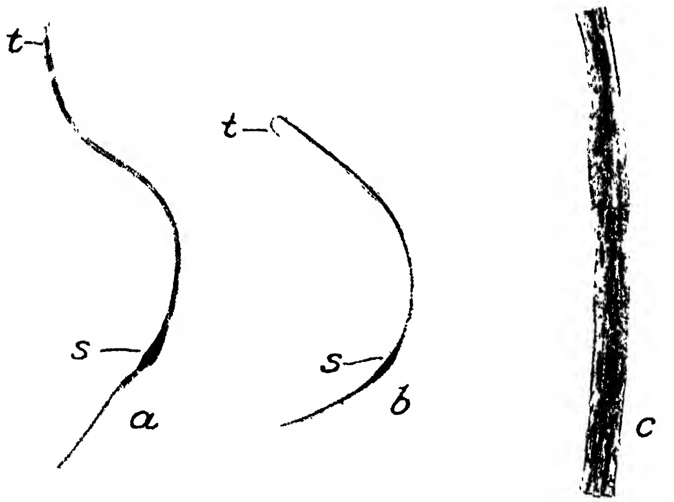


FIG. 4.

(*a*) A blunt-tipped fibre after pulling. There is some distinct smokiness in the tip at *t*, while there is a conspicuous "smoky" swelling at *s*.

(*b*) A pointed-tipped fibre after pulling. A fine whip-lash tip is shown at *t*, while there is a "smoky" swelling at *s*.

(*c*) Photomicrograph of a more obvious case of "smoky" wool such as is shown in Fig. 6. The elongated air spaces within the cortex are conspicuous. ×200.

FIG. 5.

(*a*) A fibre with a new pointed tip, but a "smoky" swelling shortly below the tip.

(*b*), (*c*), (*d*), and (*e*) Various club-ended fibres, the club being "smoky." In (*d*) individual cortical cells can be seen projecting from the distal extremity. ×100.

weakened. In more extreme cases of smokiness even the gentle stresses which are sufficient to straighten out the crimpiness may cause the fibres to snap at the smoky region. It is true that sheep are very often grasped by the wool, considerable tension being placed upon the fibres. Such a practice should be avoided both on account of the causing of additional hairiness by pulling out some of the fibres and of the production of weak smoky regions. On other occasions these defects may be multiplied when the wool becomes entangled in fences, trees, or hedges.

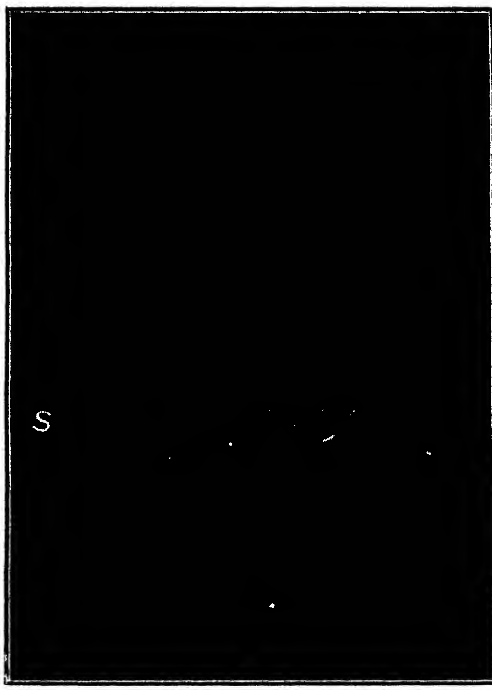


FIG. 6. PHOTOGRAPH OF WOOL SPECIMEN IN BENZOL.

Except at the tips of the staple; this sample is entirely free from hairiness. At *s* there is a conspicuous band of "smoky" wool, but such smokiness is absent from neighbouring staples, suggesting that the sample under consideration had been mishandled.

SUMMARY.

1. Preliminary experiments on the pulling-out of wool fibres are described. Regeneration of new fibres from the old papillæ begins almost immediately, the fibres beginning to penetrate through the skin at two weeks.

2. Where the hairiness of the lamb's coat extends for two to three months the hairiness of the regenerated fibres has a comparable duration and is generally as coarse as or coarser than the lamb's coat hairiness. Several cases have been found, especially in hogget fleeces, where the medulla was noticeably reduced following pulling.

3. In the case of animals possessing little or no hairy tip in the lamb's coat, the hairiness of the regenerated fibres is equal in coarseness

or coarser, and usually of little duration. It is considered that freedom from hairiness after epilation gives a good indication of vigorous keratinizing power.

4. By pulling out wool fibres a good estimation of the drive towards hairiness may be obtained from the amount of medulla in the regenerated fibres. This may be useful in normal cases where the lamb's coat is not known ; in cases where it is desired to follow the improvement in the keratinizing power ; in cases where the lamb has grown badly with an apparent reduction in the vigour of medulla-production ; in cases where there has been infilling of the medulla ; in cases where the strength of the prenatal check has caused an apparent reduction in the hairiness of the samples.

5. Wool that is mishandled by tugging it may become "smoky"—that is, show air spaces in the cortex. In extreme cases of smokiness the fibres are very considerably weakened.

The writer wishes to acknowledge a grant from the Department of Scientific and Industrial Research in aid of wool investigation.

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THE CONTROL OF STINKING SMUT OF WHEAT.

EXPERIMENTS ON SEED TREATMENT WITH VARIOUS DUSTS.

J. C. NEILL, Field Mycologist, Mycological Laboratory, Plant Research Station, Palmerston North.

THE object of the experiments described herein was to compare the relative efficiency of the dusts at present available in New Zealand for the treatment of seed wheat.

Two samples of wheat were used, one being from a line of Solid Straw Tuscan carrying a heavy natural infection of stinking smut, the other from a smut-free line of Jumbuck artificially inoculated at the rate of 1 to 1,000 parts by weight with spores of the smut.

Portions of the samples were dusted at monthly intervals from March until August, the Solid Straw Tuscan at the rate of 4 oz. of the dust per bushel of seed, the Jumbuck at 2 oz. per bushel. The treated seeds were all sown on the 14th and 15th of August in four rod rows, 100 seeds to the row, together with twelve rows of untreated seed from the same samples.

The plants were pulled and examined when ready to harvest in January, the number of headed plants and of those having one or more smutted heads being recorded. The results are given in Table 1.

Table 1.

Date treated (1933)	Mar. 15.		Apl 12.		May 15.		June 15		July 14.		Aug. 12.		Mean.	
Treatment.	Plants.*	Smutted	Plants.*	Smutted	Plants.*	Smutted.	Plants.*	Smutted.	Plants.*	Smutted.	Plants.*	Smutted.	Plants.	Smutted.
SOLID STRAW TUSCAN.		%		%		%		%		%		%		%
Control (untreated)	..	..	..	..	.	..	..	..	..	..	..	..	78	56
Copper carbonate†—														
No. 1 (18 per cent. Cu.) ..	.	..	..	.	..	..	.	..	..	..	88	0·3	88	0·3
No. 2 (20 per cent Cu.)	76	1·0	75	0 3	82	1·5	78	5·4	90	1·4	77	0	81	1·6
No. 3 (51 per cent Cu)	81	0·3	82	0 3	79	1 0	72	1·4	89	3·1	85	0	81	1·0
Copper Oxychloride (Smutol 53 per cent. Cu)	78	0·3	85	0	75	0·3	71	0	87	0	79	0·3	79	0·1
Agrosan G (1·5 per cent. Hg)	..	..	81	9·6	78	3·2	78	1·3	83	1·8	83	0·6	81	3·3
Ceresan	..	.	86	0	75	0·3	..	.	..	.	.	.	80	0·1
Ceresan New (1·3 per cent. Hg) .. .	..	..	.	.		.	72	0	83	0	79	0	78	0
Semesan (21·2 per cent. Hg) . ..	82	2·0	78	3·5	80	1·5	76	0 6	86	2·0	90	7·2	82	2 8
JUMBUCK.														
Control (untreated)	..	..	.	..	.	..	.	.	.	..	.	.	75	25
Copper carbonate—														
No 1	..	..	..	..	..	..	..	.	..	..	85	0	85	0
No. 2	71	0	74	0	75	0 3	70	0·3	82	0	80	0	75	0·1
No. 3	75	0	74	0	76	0	73	0	83	0	83	0	78	0
Copper oxychloride (Smutol)	80	0	78	0	74	0	74	0	85	0	76	0	78	0
Agrosan G		..	73	0	78	0·3	76	0·3	92	0	81	0	80	0·1
Ceresan	74	0	73	0	75	0	79	0	..	.	.	..	75	0
Ceresan New	.			.	.		81	0	90	0	72	0	81	0
Semesan	86	0	76	0	73	0	79	0	88	0	82	0·3	81	0 1

* Per hundred seeds sown. † Analyses by Dominion Analyst, Wellington.

SUMMARY OF RESULTS.

With the heavy natural infection of the sample of Solid Straw Tuscan complete control of the smut was obtained only with Ceresan New. Ceresan was nearly as effective, but the other organic mercury dusts—Agrosan G, and Semesan—were much less so. No correlation was apparent between mercury content and fungicidal value with these compounds, though the sample of Semesan had been in the laboratory for three years and may have deteriorated. Of the copper compounds, excluding the insufficiently tested No. 1 copper carbonate, Smutol (copper oxychloride) gave the best results, followed closely by the copper carbonates in the order of their relative copper content.

Infection of the Jumbuck wheat was lighter than that of the Tuscan, though still heavy enough to yield 25 per cent. of smutted plants in the sowings of untreated seed. With this wheat all the dusts controlled the smut well, only Agrosan G. Semesan, and the low-copper-content carbonate failing to eliminate it completely.

There were no significant differences in the degree of smut control shown by treatments carried out at monthly intervals between harvest and sowing.

The number of plants harvested per hundred seeds sown varied very little between any of the treatments, though in general treated seeds showed slightly better results than the untreated controls.

THE CHEMISTRY OF WEED-KILLERS.

*(Continued.)**

B. C. ASTON, Chief Chemist, and J. A. BRUCE, Inspector of Fertilizers, Department of Agriculture.

DURING the last few months, especially those of summer, continued attention has been devoted by the junior author and his staff to the trial of various possible chemical compounds as specific killers of ragwort. The substances selected included both proprietary weed-killers obtained under trade names and substances sold under their correct chemical names.

The need for this work has been repeatedly impressed upon the writers owing to the disasters, fortunately confined to single individuals, which have been from time to time reported in the press. These indicate that the accidents mentioned in the April, 1933, *Journal* are by no means the last which may be expected to occur when carelessness is allowed to creep in, in dealing with this powerful inflamant and explosive. For instance, quite recently a farmer's clothes burst into flames as a result of carrying a small amount of sodium chlorate loose in his pocket. A motor-car was burnt owing to the hood of the car being used to hold sodium chlorate concurrent with the effect of the hot sun and a certain amount of friction. The worst accident, however, was that which caused the death of a worker, a farm hand, who had neglected to change his clothes saturated with chlorate spray and who, striking a match to look at his sleeping child, in an instant became, according to his wife's account, a "pillar of flame"

INVESTIGATIONAL WORK IN PROGRESS.

During the year, therefore, some eighty tests have been made with thirty-six different substances on a number of different areas allowing differences in climate, soil, and situation to be the subject of experiment. Ragwort plants have also been grown in a garden in the seedling state row by row thereby rendering it possible to obtain more definite figures representing the kill by various treatments. Most of the experiments had necessarily to be conducted in or near Wellington City, but the assistance of Mr. C. R. Taylor, Analyst's Assistant, stationed at Rotorua, was invoked, and, as a result, interesting data on that peculiar type of country known to the majority of people as "pumice lands" was obtained. Unfortunately, the spring and summer season has proved exceptional in the rainfall in Wellington, and at the very time when it was hoped to attack the ragwort at what is probably its most vulnerable period, unseasonable and very heavy rains may have so altered the results as to render them uncertain as a guide to what may be expected in normal seasons.

The trial of ammonium thiocyanate (sulphocyanide) has been continued, and a solution of 5-per-cent. strength found to give good results at Rotorua, a complete kill being obtained, although it took some months to do so. Crude sodium thiocyanate liquor in 5-per-cent.

* Previous articles may be consulted in this Journal for February, April, and July, 1933.

solution on ragwort half grown and in flower showed great promise, and a complete kill is expected. It is expected that the 3-per-cent. solution, if properly applied, would give satisfactory results. The crude sodium thiocyanate in the form of fused cakes blackened plants very rapidly, but the stems maintained their vitality for some weeks. Wellington experience confirms this Rotorua experiment, as it was found to take many weeks to effect a complete kill after spraying. A point in favour of the use of thiocyanate is that the pasture, both clovers and grasses, is notably stimulated after the poisonous action of the dressing has passed away, the good effect being due probably to the ammoniacal nitrogen contained in the thiocyanate. Other interesting results obtained were that, in the comparison of sodium chlorate with ammonium thiocyanate, whereas the chlorate apparently benefited by the wet weather which immediately followed spraying, the killing effect of the thiocyanate was depressed by the rain. Seeing that sodium chlorate is so highly efficient as a weedicide and especially as a killer of ragwort, it was thought that other highly potent oxidizing agents might be similarly efficacious as weedicides and some of these oxidizers have given very interesting results.

Permanganate of potash proved to be a complete failure in spite of the large amount of available oxygen it contains. Bleaching-powder (calcium hypochlorite) both in a 5-per-cent. solution and applied dry was fairly successful in killing ragwort and merits further experimental work. Sodium hypochlorite in 10 per cent. solution gave better results than any other substance at Rotorua. As an academic result it is interesting to record that in the study of the effects of oxidizing salts sodium peroxide applied dry was easily the most effective substance used to kill ragwort in all the experiments, but this compound is at present far too costly to use and, of course, is highly dangerous to handle as a commercial product.

SCOPE FOR FUTURE INVESTIGATION.

In following this idea of research for an oxidizing salt which has a similar effect as a ragwort-killer to sodium chlorate without the danger of that compound, one would naturally consider the chromates. Those readily accessible on the market are the chromates and bichromates of potash and sodium. Experiments with these compounds indicate that they may prove efficient as exterminators of ragwort While not having the violent inflammatory possibilities of sodium chlorate when mixed with organic materials, they have a poisonous local effect on human beings when constantly breathed as a fine dust, attacking especially the surface of the body where the skin is broken, producing ulcers which heal with great difficulty and corroding mucous surfaces. The occurrence of cases of acute poisoning are, however, rare The use of the chromates in the arts and manufactures is so well known that there will probably be little difficulty in effecting a technique which will minimize their poisonous nature to human beings and any possible ill-effect to stock. Experiments at Wellington showed that under the conditions prevailing at the end of February, 1934, 100 per cent. kill of ragwort was obtained by spraying with 5 per cent. solution of sodium bichromate in water at the rate of under 400 gallons to the acre; half this strength being nearly as effective.

(To be continued.)

EFFECT OF EXCESS OF DISINFECTANT DUSTS ON THE FIELD GERMINATION OF SEED WHEAT.

J. C. NEILL, Field Mycologist, Plant Research Station, Palmerston North.

CERTAIN types of continuous-action seed-dusting machines at times accumulate excess dust at the delivery end with the result that the quantity carried by the seed on discharge is apt to increase suddenly to much above the normal. The fault may not be detected and remedied until one or more bags are filled with this overdusted seed. It is of interest therefore to know whether the germination of this seed would be adversely affected when sown in the field.

In the following experiment on the point, samples from a line of Jumbuck seed wheat were shaken in a closed container with some of the commoner seed dusts at 1 part by weight of the dust to 12 parts by weight of the seed—that is, a proportion of dust forty times greater than the normal 2 oz. to the bushel. The dusted seed was sown by hand in October in two blocks, one block having no manure, and the other superphosphate at the rate of 3 cwt. per acre distributed in the open drills with the seed.

Four hundred seeds were sown for each treatment, and the germination counted three weeks after emergence. The results are given in tabular form below :—

Treatment.	Percentage Germination.	
	No Manure.	3 cwt. Super.
Control (no treatment)	74	41
Ceresan New	8	46
Ceresan	2	0
Agrosan G.	69	55
Copper carbonate 20 per cent. copper ..	72	44
Copper carbonate 51 per cent. copper ..	67	56

SUMMARY OF RESULTS.

Excess copper carbonate, either high or low grade, and Agrosan G, had little or no effect on the field germination of wheat, where sown with or without superphosphate. Ceresan in excess practically inhibited germination under the same conditions, while Ceresan New caused severe injury without manure, but gave slightly better germination than the untreated seed when sown with superphosphate.

The *per capita* consumption of butter in the United Kingdom in 1932 was approximately 21·8 lb., compared with 20·9 lb. in 1931, and an average of 15·6 lb. in the four years 1924 to 1927.—*Empire Marketing Board.*

AREAS OF GRASSLAND TOP-DRESSED, 1932-33.

THE following table, supplied by the Census and Statistics Office, shows the area of grassland in New Zealand top-dressed once or more with artificial fertilizers only, artificial fertilizers and lime, and lime only during the twelve months ended 31st January, 1933:—

Land District.	With Artificial Fertilizers only.	With Lime only.	With both Artificial Fertilizers and Lime.	Total Area Top-dressed.
	Acres.	Acres.	Acres.	Acres.
North Auckland ..	330,211	12,270	90,216	432,697
Auckland	593,731	23,020	299,325	916,076
Gisborne	28,957	1,008	2,108	32,073
Hawke's Bay	89,838	4,579	8,194	102,611
Taranaki	290,345	7,793	49,112	347,250
Wellington	250,418	12,415	49,037	311,870
Nelson	18,270	2,017	7,027	27,314
Marlborough	12,395	569	1,942	14,906
Westland	4,080	2,333	3,382	9,795
Canterbury	39,495	12,101	16,392	67,988
Otago	32,305	7,345	10,528	50,178
Southland	50,990	17,502	56,864	125,356
Totals ..	1,741,035	102,952	594,127	2,438,114

In the two previous years the cognate figures for the Dominion were:—

	Season 1930–31	Season 1931–32
	Acres.	Acres.
Top-dressed with fertilizers	2,432,438	2,067,672
Top-dressed with lime ..	438,878	386,649

RETIREMENT OF MR. J. W. DEEM, DIRECTOR OF FIELDS DIVISION.

BECAUSE of the completion of the statutory forty years of service Mr. J. W. Deem has retired on superannuation from the position of Director of the Fields Division. Mr. Deem, who commenced his service at Awatere over forty years ago, later held positions as an officer of the Department at Waimate, Fairlie, New Plymouth, and Hawera before he became Fields Supervisor at Wanganui in 1913. He became Supervisor of Subsidized Demonstration Farms in 1919, and was for a period Manager of Moumahaki State Farm. In 1928 he was appointed Fields Superintendent at Palmerston North, and in 1929 he succeeded Mr. A. H. Cockayne as Director of the Fields Division.

At a large representative gathering at Palmerston North Dr. C. J. Reakes, Director-General of Agriculture, on behalf of officers of the Department, presented Mr. Deem with a gold watch and handed him a handsome tea-service for Mrs. Deem. In making the presentation, Dr. Reakes referred at length to the many good qualities and the high value, recognized for many years, of Mr. Deem as an officer of the Department. Mr. A. H. Cockayne, Assistant Director-General, in supporting the tributes paid by Dr. Reakes, *inter alia*, mentioned the vast store of knowledge of farming possessed by Mr. Deem. A message from the Minister of Agriculture expressing appreciation of Mr. Deem's valuable and faithful services to the Department was also received.

SEASONAL NOTES.

THE FARM.

The Role of Top-dressing.

In farming, and particularly in dairying, during the current difficult times, a consideration of prime moment relative to any practice is its bearing on the cost of production At times, farmers, if they can be judged by their actions, are not guided in their decisions about top-dressing by its prospective bearing on their farming costs. In this connection it is of moment that an increase of say 20 per cent. in production due to the use of fertilizer on grassland usually represents much more than an increase of 20 per cent. in net returns This is because the overhead charges for land, equipment, and labour would be substantially the same for the lower as for the higher production, and hence the main items that should be set against the value of the increased production due to top-dressing are the cost of the manure and the interest and depreciation on the extra stock utilized. The position may be illustrated by consideration of a sheep farm, the carrying-capacity of which is increased by top-dressing from 1,500 to 2,000 ewes In such a case the top-dressing may rightly be credited with the whole of the returns for the extra 500 ewes less only the cost of the fertilizer and the cost of interest and depreciation on the extra stock. Alternatively the relationship of top-dressing to cost of production in such a case may be gauged from the fact that top-dressing would result in heavy fixed charges—such as annual cost of land, equipment, and labour—being spread over the returns of not 1,500, but 2,000 sheep, representing a fall of 25 per cent in these fixed charges, provided the value of the production of stock units remained constant If the value of top-dressing were estimated carefully in this way as often as it should be, then there would be a substantial increase in the amount of fertilizer used in top-dressing

While in some instances, in view of current produce prices, top-dressing may not affect the returns enough to turn an unprofitable farming proposition into a profitable one, it may be expected, as a rule, to make unprofitable farms less unprofitable

Judgment in Top-dressing important.

Two qualifications attach to the preceding statements relative to the value of top-dressing. In the first place, the statements presuppose judicious expenditure on top-dressing. At times expenditure on top-dressing is far from judicious, and so it seems worth stating that top-dressing practice should be based on evidence provided as a result of local field experience. Too often farmers are swayed in respect to their manure purchases by tradition, by semi-scientific or by pseudo-scientific jargon, or by accounts of varying accuracy about experience in other districts in which the conditions may or may not be essentially different. As a result, outlay is dissipated on top-dressing material from which little or no benefit seems to be obtained, whereas often equal outlay could be made on other material which would give eminently attractive results. The uncertain value of guidance taken from experience in other districts is strikingly exemplified in the case of the use of both lime and potash. In certain districts definite visible benefit follows the use of one or both these substances on grassland. Though at times the economic value of this beneficial effect may not have been

measured accurately, the effect is striking enough to justify the use of the substances either freely or fairly extensively in a trial way. On the other hand, in certain other districts, sometimes not far distant from the former ones, visible benefit results from neither lime nor potash applied to pastures, and recommendations to use lime or potash in the latter districts cannot be justified because of the experience in the former districts. Yet, strange as it may seem, top-dressing is at times based on such recommendations.

The influence of tradition and of miscellaneous jargon commonly replaces the influence of field evidence as the basis of liming. For instance, it is to some extent a tradition that liming will improve stock in respect to bone-development. Before attaching much weight to this as a basis of specific top-dressing action, it is well to establish whether stock show any deficiency in bone-development, and, if so, to inquire further whether phosphatic manures which normally enrich the pastures in lime and phosphoric acid—both of which are essential for bone-development—could not be advantageously employed to remedy the weakness In a somewhat similar way the traditional use of liming as a means of reducing the incidence of stock disease should be considered If this is done it will often be found that no causal connection between liming and disease has been established in respect to some districts in which liming has been advocated largely as a means of coping with stock diseases. However, there are occasions in which reduction in disease has been associated with liming The need is to restrict suitably the application of conclusions deduced from such occasions. Elementary as the above reasoning about the basis of top-dressing may seem, it is so often violated that farmers might well ask themselves whether their top-dressing is founded on comparable field experience or on one of the other bases such as tradition, &c

Top-dressing not always advisable.

In the second place, general statements relative to the value of top-dressing always should be restricted by the qualification that there are grassland areas for which top-dressing is not recommended This is likely to be true, for instance, of land of relatively low carrying-capacity, and especially is this so when low prices prevail In illustration of this, improved price of wool and lambs may make top-dressing profitable on sheep country where it previously would have been unprofitable. However, the areas on which wet stock are carried and on which top-dressing is not advisable are exceptional, and a farmer should satisfy himself that his is one of the exceptional areas before he decides to forgo the substantial assistance usually obtainable from appropriate top-dressing.

Phosphatic Top-dressing.

The widespread value of phosphatic top-dressing has been definitely established. In general, the supply of available phosphate is the weakest link in the chain of food requirements of pastures, though in a few cases the weakness in respect to lime rivals, if it does not equal, that in respect of phosphates, and in other cases, seemingly fewer still, this may be true of the weakness in respect to potash. Hence, in general, the basic need is phosphatic top-dressing. Of the phosphatic manures superphosphate is most largely used. The popularity of superphosphate is supported by field observations; it gives superior results under low-rainfall conditions, and where the rainfall ranges from moderate to high it generally, at least, equals, if it does not excel, other phosphatic manures; of the phosphatic manures, it most quickly brings about increased growth; it usually continues to stimulate growth

for a longer period than many realize—the continuation of substantial benefit from superphosphate after twelve months has been noted, and it does not cause any permanent increase in the sourness of the soil.

On certain farms splendid results have been obtained from the use of basic slag, and on these the use of slag should not as a rule be departed from, except in a trial way, until the economic superiority of that which is to replace the slag has been established.

The Place of Potash and of Lime.

In some districts—for example, in parts of Taranaki and Southland—official trials have given indication of definite improvement from the use of potash on grassland. In districts in which such results have been obtained fairly extensive trial use of potash at least is justified. Apart from the particular districts in which it has been noted that improvement of pastures has been associated with the use of potash, no field evidence which would justify recommending the use of potash in top-dressing generally has been obtained. The material known as "30 per cent. potash salts" is, as a rule, the most economical source of potash for grassland.

The view, based to some extent on hazy tradition, that there is necessarily concord between liming and sound farming, is not now accepted. In New Zealand liming of grassland has produced very diverse results; sometimes liming brings about striking improvement and is obviously advisable, at other times it gives no apparent effect. In some instances, indeed, it appears to have a depressing effect, especially when used in conjunction with the slowly acting phosphates, and occasionally even when used in conjunction with superphospahte. In view of this, liming should be based on evidence of its bringing about profitable benefit under local comparable conditions.

Liming by itself is seldom financially attractive and so it is inadvisable, as a rule, to substitute the use of lime for the use of such artificial fertilizers as superphosphate and basic slag, the value of which already has been conclusively established. But if such artificial manures are not giving satisfactory results, the trial use of lime in conjunction with these is well justified. Normally, at the present time, a dressing of a few hundredweights an acre of lime is preferred to the much heavier dressing that found some favour in the past. As difficult times bring about a search for economy, increased current importance attaches to the fact that liming as a cheap alternative to other top-dressing of proved value is as a rule false economy.

Autumn Management of Grassland.

Coarse, mature, woody herbage may remain on pastures from the summer period of rapid growth. As a rule, such growth should be removed in the autumn; it delays the ready development of the fresh leafy condition which at this season characterizes fields which have been well grazed throughout the year. If it is not practicable to utilize store stock for the removal of the tall mature growth, then it becomes advisable to remove it by "topping" with the mower.

Harrowing of pastures as a means of properly distributing animal droppings is widely advisable in March. The thorough distribution that is desirable usually calls for two harrowings. One harrowing at right angles to the other is more effective than two harrowings in the same direction around the field. Grass harrowing also at times is advisable for the purpose of breaking up a matted compact sward.

When the area that it is practicable to top-dress is limited a special endeavour should be made to top-dress newly established pastures—it is likely to be more economical to prevent early deterioration of

young pastures by means of suitable top-dressing than later to renovate swards which have suffered because of insufficient fertility in their early stages.

The Cereal Crops.

In the autumn much important work with cereal crops demands attention. During recent years valuable additions have been made to our knowledge relative to such work, and information about the most effective known practices may be obtained from district offices of the Fields Division.

Because firmness is desirable in the seed-bed for wheat it often becomes possible to dispense with ploughing when wheat is to follow potatoes or peas, thorough disking being sufficient. When wheat is to follow pasture, skim ploughing should be done early in the autumn, and if it has not already been done, it should be proceeded with as quickly as possible. After the skimmed furrows have been exposed to weathering for six to eight weeks they should be disked and the land then ploughed to the full depth. When wheat follows a previous cereal crop, the stubble should be disked or grubbed and the land later ploughed to full depth.

In the main wheat-growing districts of the South Island autumn or early winter sowing should be practised whenever possible. In the most southerly wheat areas and in the North Island spring sowing is usually most suitable.

Oats to be used for the production of winter and early spring feed and subsequently to be allowed to develop for grain or chaff should be sown in April or in early May. The proved kinds of Gartons are the best all-round type for the South Island. Algerians are deservedly popular for the production of green feed and for the provision of good chaff. Gartons which do not stand grazing to the same extent as Algerians should be fed off once only and that quickly. When barley and Algerian oats are grown primarily for green feed, a succession of grazings when the growth is relatively low usually proves preferable to a single feeding-off of tall growth. The grazing of short growth lessens waste by trampling, and the feed provided is more attractive.

For autumn sowing of cereals clods on the surface are desirable rather than undesirable- they tend to provide shelter for the seedlings and to check the setting into a hard layer of the surface soil.

Extensive investigation has shown that over wide areas in the South Island the use of 1 cwt. an acre of superphosphate with wheat gives profitable results, and much the greater portion of the South Island wheat crop is manured in conformity with this finding. As a general rule autumn-sown oats and barley will respond profitably to an application of from 1 cwt. to 2 cwt. an acre of manure of which superphosphate is the principal constituent.

Widespread diseases of wheat, oats, and barley may be controlled by suitable treatment of the seed prior to sowing. Appropriate treatment of seed oats and barley is not carried out so generally as treatment of seed wheat, but there is just as much need for it in the case of any crop that may possibly be harvested for chaff or grain. Neglect of the treatment of Algerian oats seems at times to arise from the belief that it is free from attacks of smut to which it is just as subject as are other varieties of oats. Additional results of research work relative to treatment of seeds of cereals are now becoming available. Full particulars of these may be obtained from local officers of the Fields Division.

General Crop Work.

If early frosts have not already injured such crops as maize and millet, they should be turned into silage or hay. Silage should be made in preference to hay if the amount of green material available is not so small as to lead to undue wastage in silage; it is somewhat difficult to dry safely the relatively coarse stalks of these crops.

Swedes attacked to any considerable extent with dry-rot should be fed without any avoidable delay.

Autumn management of lucerne is of importance. At times the growth made during the latter part of the season is grazed. In the interests of the lucerne such grazing is usually inadvisable as the trampling that results favours the entrance of grass. This is particularly true of districts of good rainfall in which grass is at times one of the worst weeds invading lucerne.

— *R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Fruit Export Work.

FROM now until the end of the export season, the harvesting of mid-season varieties of apples and pears will allow for little time or thought for any other work than the picking, packing, grading, &c., of fruit for shipment overseas. In picking fruit for export there are three main essentials that must be kept prominently in mind—namely, colour requirements, stage of maturity, and size. Under no consideration should one be sacrificed for the other. When the fruit has attained the proper degree of maturity for picking for export no time should be lost in removing it from the tree, neither should any time be lost in packing and despatching. Once removed from the tree the fruit quickly matures. If it is allowed to remain in the shed too long either before or after packing the fruit may become over-mature for export. Pears especially should suffer as little delay as possible between picking and despatch. The overlapping of varieties, which unfortunately cannot be avoided, is apt to lead to trouble owing to the natural tendency to hurriedly finish with one variety before commencing another. This practice should and must be discouraged, as it often leads to rejection at the inspection point owing to lack of colour and immaturity. It is advisable to leave the final picking of a variety until the remaining fruit has sufficiently matured and coloured. In the meanwhile the first and perhaps the second picking of the overlapping variety can be gone on with. A word of warning which should not be ignored was sounded in the January notes regarding the rough handling of fruit for export and for local markets.

Cool Storing for Local Market.

Fruit intended for cool store for the local market should receive the same careful handling and consideration as that given to fruit intended for export. It should be carefully graded and packed, and placed in storage with as little delay as possible. The need for rejecting all fruit unsuitable for storage cannot be overemphasized — that is, all fruit showing bitter-pit, skin-puncture, skin broken at stem, windfalls, and those carrying an excessive amount of black spot - *i.e.*, one square inch in the aggregate. Fruit with a broken skin should be rejected because rots are likely to develop in the damaged tissues and cause much wastage in the fruit.

Ordinary Storage of Fruit.

Although fruit cannot be kept in ordinary orchard stores for such a long period as in cool stores, the practice of storing fruit in the former is quite satisfactory in so far as fruit which otherwise would reach a glutted market can be kept for several months without undue loss. It is, of course, imperative that the same careful handling, grading, and packing be observed as that for cool storage. Good ventilation is most important. The damage caused by rats and mice to fruit in ordinary storage may be considerably reduced if a good cat is kept in the store.

Seasonal Spraying for Pome Fruits.

Owing to the danger of late infections of black-spot and powdery-mildew it is advisable to apply one or more dressings of the combination spray as specified below to late varieties. The actual number of applications necessary will depend on the prevailing climatic conditions in each district. Late black-spot infection will result in what is termed a pin-head black-spot, which is sufficient not only to debar such fruit from export but to reduce it on the local market to a grade below second grade. Codling moth and leaf-roller caterpillar may also cause considerable damage to fruit crops. For the control of these diseases and pests apply lime-sulphur 0·083 per cent. plus colloidal sulphur 2 lb. and lead arsenate 1½ lb. (powder) in 100 gallons spray. Bordeaux 3-4-50 is recommended for pears.

Seasonal Spraying for Stone Fruits.

About two or three weeks after first picking, trees of stone fruits should receive a dressing of the following combination spray: Lime-sulphur 0·083 per cent., plus colloidal sulphur 2 lb. to 100 gallons spray. Should black and green aphis appear it is advisable to apply a 1-per-cent. summer-oil spray and to repeat in four or five days if insects persist.

For leaf-roller caterpillar on plums and cherries, it is advisable to apply 1 lb. lead arsenate plus 3 lb hydrated lime per 100 gallons water.

Should leaf-roller caterpillar be present on peaches, nectarines, or apricots, one or two 1-per-cent. summer-oil sprays should be used, as these trees will not tolerate arsenates.

J. W. Whelan, Orchard Instructor, Palmerston North.

Citrus Culture.

Ordinary routine work in all citrus orchards should be carried out, such as cultivation and sowing of cover crops where necessary. The recent rains should cause these to come away rapidly. It may at times be difficult to know what to sow, however, there are quite a number of legumes that do quite well in most localities such as lupins, peas, vetches, and horse beans. It is of primary importance that some means be employed to keep the soil well supplied with organic matter, otherwise trees and plants cannot thrive.

Before sowing such crops, the soil should be worked so as to provide for the removal of any surplus water that may fall. This is easily done so long as the soil is worked towards the trees, and after sowing a furrow is drawn down the centre of each row with the slope of the land. Stagnant water is very detrimental to citrus trees, and should always be guarded against.

A few words giving a simple outline of some methods to follow in order to cure lemons without going to a great deal of expense may be timely.

The lemons should be cut from the tree, close up to the button, leaving no stalk to scratch other fruit. It is advisable to harvest when the lemons are of commercial size irrespective of colour and to separate the green from the yellow lemons, as they behave differently in curing. It is advisable to convey them to the shed in flat boxes or trays and to avoid bruising and scratching. If damp or sappy they should be spread on a table to dry for twenty-four hours.

They should be placed on shelves in dry sand, chaff, or sawdust, or packed in kerosene cases, and kept in a cool well-ventilated shed.

If these few precautions are taken the amateur grower should not have any difficulty in curing his own lemons.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING

The Culling of Poultry and the Selecting of Breeding-hens.

Before beginning to cull a pen of birds, the operator should know, and give due consideration to, the conditions under which they have been kept, and also the age of the birds he is about to examine. For instance, if the flock has been subjected to a sudden change of feed especially during December or January, many good birds may have been driven into a moult, and the same thing is likely to happen if the flock has been underfed. In fact, when a large percentage of a flock ceases laying and goes into a moult before the New Year, it is usually a case of underfeeding. Birds that were in houses where artificial light was used last autumn and winter will usually moult a little earlier than others Again, the age of the birds must be considered, for, generally speaking, yearling hens that began laying in February of last year can hardly be expected to lay so late into the autumn as the second-year hens that did not begin laying until about August last, as the latter were moulting during last autumn It is better that the different ages be kept separate, or, where this is not practicable, that they be marked.

The most business-like and profitable plan is to cull regularly throughout the year and get rid of the unprofitable birds as soon as they can be detected. This not only keeps the flock on a better paying basis but also allows more room for the growing stock. However, the best time to select breeding-stock is during February and March, before many good birds have begun to moult. In the culling of a mixed flock the following matters are worthy of attention --

(1) Most birds that are two and a half years old and over should be put out as soon as they stop laying, for after the majority of hens have been through two laying seasons they are usually no longer profitable commercial egg-producers. However, if some of the two-and-a-half-year-old hens are of exceptional breed and type and still show vigour and activity, they should undoubtedly be retained for the breeding-pen. Experience has shown that from a good flock of birds about 15 per cent. of these two-and-a-half-year-olds are fit to be retained for another breeding season.

(2) The first birds of a given age to moult should be culled, for such birds are usually those of weaker constitution. The last birds to moult in a flock are generally the strongest and best producers.

(3) Any overfat or exceptionally heavy hens for the breed they represent may also be culled, the fact of their becoming overfat indicates that they are probably poor in respect to egg-production, for the exceptionally heavy hen is seldom a good producer Overfat Leghorns can usually be picked by their yellow legs and beak at this time of year.

(4) Birds showing want of vigour and vitality should be culled. These can be picked out by their want of activity and, generally, looseness of feather, also dullness of head and eye. Physical activity is one, if not the chief evidence of constitution and health. Slow-moving or sluggish birds are never heavy producers. The hen that is constantly hunting for food and never seems satisfied with what is given her is usually amongst the best layers in the flock. The big eaters are, as a rule, the layers; they go to roost late and are the first off in the morning. With layers, increased food consumption means increased egg-production. and failing appetities a poorer egg yield. It therefore follows that the great egg-producers have a good crop capacity and as they are digesting a large quantity of food they usually possess a good depth of abdomen—in fact the deepest part of a good layer's frame is straight down from where the tail comes out of the body, and the legs will be well back and set well apart. The head

points can hardly be overestimated when selecting layers. The best layers' heads are usually inclined to be rather long for the breed they represent, fairly fine, but showing strength and character. The small, round sparrow or pigeon-headed bird generally belongs to the poor producer.

The comb of the hen which is laying heavily is of a rather pale red colour and has a warm waxy feeling. It should be of medium size and thickness, not coarse but not flabby, and with good layers the comb usually follows the line of the head and seldom does one find the best layers with a comb sticking up at the back. The wattles should be fine in texture and carried fairly close together, the eyes large, in fact the larger the better, also bright and prominent. The eyeball of the best layers, especially with heavy breeds, is generally situated a little back from the centre, whereas with the poor producer it is more towards the front of the socket and sunken.

Feathering is of importance. The strongest and best birds are usually closely and tightly feathered. Softness and looseness of feather generally belong to the coarse bird of slow maturity and low production. It will also be observed that the birds which show lack of confidence and which are nervous or wild, and those that remain at the back of the flock at feeding-time, are not amongst the best birds, but the best are often amongst those which are neither too tame nor too wild, and which are not easy to catch.

When culling Leghorns or any of the yellow-fleshed birds, the leg and beak colour are good guides to production. As a rule, when well-reared Leghorn pullets start to lay they have yellow legs and beaks, but as they continue laying the colour fades, first from the beak, then from the legs, so if one finds Leghorn hens at this time of the year with yellow legs and beaks it may be taken for granted that such birds have not done much laying for some time, and should be culled

After a flock has been culled, the best of those remaining should be selected for the breeding-pen ; and as the breeding-hen is the foundation of the poultry industry, a poultryman's success will depend largely on the care taken and knowledge shown in this branch of work The three great essentials to keep in mind when selecting breeding-stock are (1) purity of blood , (2) vigour and constitution , (3) capacity to produce and reproduce. Purity of blood is mentioned first, for a poultryman can hardly expect to make much lasting progress if he breeds from mongrel stock, and has no definite standard at which to aim. It is also very desirable to know something of the history or pedigree of the birds to be bred from. A pure line from parents that have been noted for constitution and the production of good-sized eggs that produce good liveable chicks is what is needed.

The chief characteristics of the best birds will be approximately as follows : *Head* fairly fine, showing strength and character, not coarse, but rather wide at the top, and of fair length. As before mentioned, low value is attached to the small, round, sparrow- or pigeon-headed birds *Comb* of medium size and thickness, but not coarse or flabby *Wattles of* medium size, fine in texture, and carried close together. *Feathering* hard, tight, and dense, and often of a worn threadbare appearance, while many good Leghorns have a more or less straw-like tinge in the feather at this time of the year. *Body* will show length, depth, and width, with a good crop capacity and depth of abdomen ; back rather flat with width carried well back to the tail. The texture of the abdomen should be fine, silky, and flexible to the touch. This is a most important point. Legs of a medium length carried well back, and wide apart. *Size* · It is well to keep a close eye on this point, for, as a general rule, the tendency is for the average size, of a poultryman's birds to get smaller. In fact, some poultry-keepers consider that a bird must be on the small size to be a good layer. The sooner, however, that we all realize that smallness is not the cause of good egg-production, but its effect, the better it will be for the

industry. It is desirable that Leghorn hens that are picked as breeders weigh, say, from 4 lb. to $4\frac{3}{4}$ lb. for eighteen-months-old birds, and $4\frac{1}{2}$ lb. to $5\frac{1}{2}$ lb. each for two-and-a-half-year-old birds.

It is not often that the very early layer makes the best breeders, which are generally a little larger than the very best layers in the flock, and come from those that develop their frames first and the internal organs after.

There is a tendency with many poultry-keepers when selecting their breeding-hens to go for numbers, often at the expense of quality. This, is a great mistake.

Years of experience show that to get 40 per cent. of breeders from a good flock of eighteen-months-old birds is doing very well.

—*C Cussen, Poultry Instructor, Christchurch.*

THE APIARY.

Preparations for Winter.

THE time is at hand when it is of paramount importance that proper preparation be made for winter in the apiary. If the colonies are to winter in good order, so as to escape the abnormal losses which sometimes occur, then it behoves the beekeeper to attend to the leading factors that ensure successful wintering. The attendant evils of neglect are starvation, spring dwindling, and poor colonies, these latter being of little account when the next season's flow arrives. Among the most important factors which make for success are a strong cluster of bees, a good queen, plenty of good stores, and protection.

It is safe to say that too little attention is paid to wintering the colonies with strong clusters of young bees. Having secured a crop of honey, and noting that the colonies are strong in bees, the beekeeper is often satisfied to trust to chance. At the close of the season the colonies are likely to contain a large force of bees, but the majority, having helped to gather the season's crop, are old, and in consequence cannot be taken into account in wintering. As a result, unless large numbers of young bees are being raised to take the place of the old stock, the colonies will dwindle seriously in the spring, or become a total loss in winter. Every effort must be made to keep up breeding well into the winter, and it is often advantageous to stimulate the colonies by autumn feeding.

Next in importance is the necessity for the colony to be headed by a good queen. Too little attention is paid to superseding failing queens. A queen that has laid vigorously during the honey season is likely to become worn out and her powers of reproduction diminished. In all cases such queens should be replaced and a vigorous young mother supplied. It often happens that the bees recognize a failing queen and set to work to supersede her, but this work should be anticipated by the beekeeper. Other things being equal, stocks headed by a vigorous mother are likely to keep up late breeding, with a result that the colonies will come out in the spring with a prolific queen, and the bees attendant upon queenless hives will be greatly diminished.

If the beekeeper studies his interests and the welfare of his bees, he will ensure that every colony goes into winter quarters with plenty of good stores. This is a most important factor, and upon it depends largely the staving-off of starvation which faces the bees during the months which follow. The colonies that are supplied with honey winter safely, build

up early in the spring, and are ready to take advantage of the nectar from the early-flowering plants. Beginners often ask how much honey should be left for the bees to winter on. The amount necessary must to some extent depend largely upon locality, and care must be exercised, more particularly in the South, to provide sufficient food so that winter feeding may not have to be resorted to. In the North winter feeding may be successfully carried out, as there is not the same risk in breaking up the clusters as there is in the extreme South. In no case should a colony be left with less than 30 lb. of sealed honey, and it is wise to increase this amount to 40 lb. Abundance of stores is essential if winter losses are to be eliminated altogether.

Another important factor in safe wintering is that of protection. This may be provided by housing the bees in good watertight hives, and protecting them by good shelter hedges or fences. Great winter losses occur every year in this country through lack of attention to the hives, more particularly to the roofs. Leaky roofs should not be tolerated under any circumstances. By allowing the roofs to leak the mats and hives become damp, and the consequent drain on the stores is largely in order to keep up the heat of the cluster for safe wintering. Where the bees are kept dry the amount of food consumed to keep up the heat of the cluster will be small as compared with the stores eaten where proper protection has not been afforded by the beekeeper. New Zealand in general being a wind-swept country, it behoves the beekeeper to see that the bees are located in a sheltered position. Cold winds militate against brood-rearing, and also prevent the bees from taking a cleansing flight during the spring months.

— *E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

THE present time is the harvest period for these crops in a special sense, and by carefully considering the merits of each they can be used to best advantage. Correspondence shows many crops are seriously injured or lost just for the want of careful inspection when harvesting and consideration in storage.

Harvesting and storing main crops of onions and gourds were dealt with last month. The late potato crop will now be one of the most important receiving attention. Digging is generally best done promptly in fine weather when the land is dry as soon as the crop shows signs of ripening. Delay may mean a second growth, or spread of disease or pests from the tops to the tubers as the former die down. The season generally has been dry, and, as is to be expected, reports of serious loss from the attack of potato-moth have been received. Where this pest is present, or likely to be, the precautions mentioned in the December number of the *Journal* must be carefully observed, or the pest will increase in storage and the tubers be riddled with larvæ. To keep potatoes in condition they should be stored in a shed or pit that is dark, cool, but frost-free, and ventilated. In a shed they may be in sacks or piled in bins. To pit them, well-drained ground in a cool position should be chosen. The pit is dug but a few inches deep, 5 ft. or 6 ft. wide, and as long as necessary, placing the soil in equal ridges on each side. The potatoes are then tipped and piled as high as possible in a long ridge. The sides are then covered to a depth of 6 in. with straw or fern, and this is then covered with soil, 3 in. deep, to within a foot of the ridge. After an interval of a month

or six weeks, when the respiration of the tubers has declined, the soil covering may be completed and increased to a depth of about 6 in. For long storage the crop should be definitely sound; where the condition is mixed, or even where the potatoes have been carefully picked over, it is advisable they should be used up without delay. Seed potatoes should be kept in a shed, as described above, except that a certain amount of light is beneficial. They may be boxed, and for early varieties and small quantities this is generally most convenient. The danger of attack by the potato-moth should be watched; in most districts this passes during the month of May.

In the warmer districts, especially where there is a fair to heavy rainfall, the ordinary potato crop is rather difficult; but the sweet potato, or kumara, generally grows well—for this and other reasons it is increasing in popularity in such areas. While the crop is best left growing as late as possible, it must be lifted before there is any frost, or the tubers immediately under the crown are liable to injury. If frost kills the vines the kumara should be dug immediately, as decay sets in on the dead vines and may pass down to the roots. Digging must be done with the greatest care, as the slightest damage at this stage prevents the tubers keeping; storage losses are chiefly due to faulty handling before curing. The last-mentioned operation is usually done by gathering the kumaras into heaps and sweating them for a week before storing them. They may be stored in sand so long as it is perfectly dry, but boxes are perhaps most suitable for small quantities for one's own use.

In America, the home of the kumara, a great deal of interest has been taken in working out good storage methods. The main features are warm, dry, well-ventilated chambers. Fires are started in stoves two or three days before digging to heat and dry the storage-house. Crates filled with tubers are then stacked in a chamber in a way that permits ample ventilation and circulation of the air all round them, and as soon as it is full the doors are closed and the temperature is raised to 80° to 90° F. and kept there during the curing period. Humidity is kept as low as possible; it should never exceed 65 to 70 per cent. saturation. The time required for the treatment may be ten to fourteen days after the last tubers are stored. Common tests indicating that the kumaras have been sufficiently cured are said to be (1) non-slipping of the skin, (2) the appearance of purplish buds; and (3) the dry spongy character of the skin.

As soon as the kumaras are cured the temperature is lowered to 55° F., and kept near that point during the whole period of storage. Frequent errors in management are given as rough handling, storing crop infected with disease, allowing the fire to go out occasionally during curing, not guarding against rodents, permitting sudden changes of temperature, failing to ventilate in warm weather, and, finally, disturbing the produce before it is intended for immediate shipment. These points should receive consideration from those growing this crop for sale.

Other root crops reaching maturity now are parsnips, carrots, beet, salsify, and artichokes. In the cooler districts main crop carrots and beet are sown about the month of October and lifted now for winter use. If allowed to remain in the ground, carrots are inclined to split and the beet becomes coarse and loses flavour. Care is needed in trimming beet or they will lose colour when cooking. The leaves especially must not be removed too close to the crown; it is best to twist them off. In a clean, cool, ventilated shed that is sufficiently humid these roots keep well with little attention. Small quantities in places where they are inclined to dry out and shrivel will maintain their condition if kept in moist sand. In districts

sufficiently warm sowings of these roots may be made in early autumn when they may be left in the ground through the winter without injury and finally lifted in spring, before vigorous growth commences. Stored roots have by then been finished or are in poor condition, and the young fresh supplies are appreciated. Parsnips, salsify, and artichokes are best left in the ground over the winter and lifted as required. To avoid having to disturb the ground when wet it is often convenient to keep a moderate supply of these roots in sand.

The importation of haricot and lima beans indicates a considerable demand. It should be more generally known that almost any varieties of these beans are suitable for use in a similar way, but self-coloured seeds, such as the white, green, or various shades of brown, are preferred. Any dry beans in excess of those required for seed may be cooked, and it is a good plan, where the climate and soil are suitable, to make in season additional sowings for this purpose.

A piece of well-drained land in good heart should now be selected for planting in cabbage, cauliflower, and lettuce for spring cutting These plants should be steadily established and not pushed with nitrates until spring growth commences naturally. The same crops may now be sown in seed-beds for planting out in early spring Sow rather thinly so they do not hold water unduly, and, in colder districts especially, make the beds of such a size that they may be covered with a cold frame and the seedlings given protection in rough weather.

Preparing Land for Future Cropping.

Many people have an aversion to planning for the future; they prefer sudden spontaneous action carried out with enthusiasm and haste This is very possibly a suitable procedure for undertakings of many kinds, but in undertakings horticultural it is the commonest and deadliest blight we have Successful garden cropping over a long period at a moderate cost can only be done with an intimate recollection of past experience, consideration of present opportunities and demands, and also the possibilities of the future It compels hard thinking, careful consideration, methodical planning, together with a watchfulness that is always ready to meet the vagaries of nature as far as possible. All undertakings of the kind that are important or in which one is interested should be done in this way, and the result cannot fail to be of value

In the vegetable garden the labour will be less and the results better if the crops are classified and grown in a succession that will benefit the soil mechanically, chemically, and biologically, instead of making it barren Market demand often seriously limits the different kinds of crops grown and a good classification is then difficult; under such circumstances it may be advisable, and where the land is light it certainly would, to lay down an area in grass and clover for a season or so to recuperate. The following grouping of crops is of practical value: (1) The group of plants known as Brassica includes the different kinds of cabbage, cauliflower, sprouts, kale, and turnips; they have common tastes as regards lime and a rather rich soil; they are also susceptible to similar diseases and pests. (2) A group not so closely allied to one another are those which are deep-rooting, such as carrots, beet, parsnips, &c. Fresh organic manure is injurious to all of these, as it encourages fibrous roots instead of the clean fleshy tap roots that are desirable. (3) A third group consists of peas, beans, salads, and other shallow-rooting crops that thrive on a generous diet.

Such a classification is the basis of most rotations, and, when adopted, greatly facilitates the work.

When a rotation based on this grouping is followed: (1) The land which carried shallow-rooting crops during the past season will now be trenched or double-ploughed for root crops. (2) Land in which roots are now standing will be heavily manured and dug as it becomes available in preparation for the Brassicas; preparation which includes, it should be remembered, a pound or so of finely ground limestone per square yard hoed in after digging. (3) The area at present carrying the winter crops of Brassicas, and to which the spring crop will shortly be added, will receive similar preparation, as it becomes available, omitting possibly the lime, in readiness for such shallow-rooting crops as peas, beans, and salads. By dividing the available area into three equal parts, systematic cropping on these lines will soon show an improvement. Such perennial crops as rhubarb, asparagus, small fruit, and herbs can very well have a plot to themselves in the home garden

When new land has to be broken in for this class of cropping it must be done thoroughly or weeds are propagated instead of the land being cleaned. Two preliminary considerations are drainage and shelter. Desirable land for this work is often low-lying and drains, open or piped, are required. It is false economy to neglect this attention where it is really necessary. In some instances a good alluvial soil is over-drained by having a shingle subsoil, and in that case a water supply is an urgent consideration

Good shelter is required by the heavy-bearing crops of the present day. Its position, extent, and composition must be carefully considered before planting, and it should be carefully tended afterwards, as no crop is more important. Useful temporary shelter may be made with manuka brush woven in wire or with strips of maize.

Cultivation should commence as early as possible, as it takes some time for the beneficial effects of drainage and cultivation to develop to any extent Where the land is heavy and difficult it may even be necessary to confine the cropping to the bigger seeds and plants for the first season until a fine tilth is acquired.

Nut-culture.

New Zealand walnuts receive wide recognition on the local markets. The "meat" is easily extracted and of good flavour when the nuts have been well dried off. If they were put over riddles to eliminate waste and under-sized nuts, moderately hand-picked to remove empties, and gathered before they discoloured or washed to clean them, they would be quite a creditable product. Alluvial land in most of the drier districts is very suitable for the production of walnuts and almonds. As secondary shelter, shade, or as an avenue they are useful, in addition to the crop produced. It is important that the ground beneath the trees is smooth and well grazed or harvesting is difficult.

Cones of the stone pine, *Pinus pinea*, when spread in a warm place, quickly release the nuts they hold so tightly. On sheets of paper on the plate-rack over the kitchen stove is a good place for experimenting.

Chestnuts and hazels produce useful timber as well as nuts, and are less particular as to locality. Where these crops are to be harvested now the ground beneath the trees should be cleared and the nuts gathered at short intervals to prevent discoloration. A pole to shake the upper branches of the larger trees will be of great assistance. The nuts when gathered are then placed in trays and thoroughly dried before shipment or storage.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: FEBRUARY, 1934.

Dominion Meteorological Office.

NOTES FOR FEBRUARY.

VERY dry conditions continued during February in Nelson and Marlborough. The spring and summer in those provinces have been the driest on record and come as the culminating point of four dry years There is a very serious lack of moisture in the subsoil, and the question of winter feed for stock is causing great anxiety. The west coast of the South Island also experienced a very dry month. In Canterbury, though the rainfall was below average, the humid conditions delayed harvesting. Heavy rains were experienced in the North Island and were of enormous benefit to pastures.

Rainfall.—The only parts of the North Island which had less than the average rainfall were in central and northern Taranaki, the southern Waikato, and portions of the Auckland Peninsula. Much of the remainder had twice the average and many places considerably more than twice. The week from the 7th to the 13th was a particularly wet one, especially in the south Auckland, Bay of Plenty, Poverty Bay, Hawke's Bay, and central districts.

In the South Island, some parts of southern Marlborough, most of Otago, and the interior of South Canterbury recorded more than the average fall, the excesses being large in places in Central Otago. The rest of the Island had considerably less than normal.

Temperatures.—Except in Otago and Southland, temperatures were below normal, the departures being largest in eastern districts of the North Island.

Sunshine.—The amount of bright sunshine recorded did not differ greatly from normal. In the North Island it was rather less, but in most of the South Island rather more.

Pressure Systems.—There were two principal storm systems which affected New Zealand during the month, each of which commenced as a vigorous cyclone in the coastal area of Queensland and caused extensive flood rains in the eastern Australian States. In each, the eastward movement was very slow. The first appeared near Mackay on the 1st February, and, travelling slowly in a south-south-easterly direction, became a very deep and violent storm by the 4th, when it was situated west of the centre of the Tasman Sea During this period there were easterly winds in northern New Zealand, and the unsettled weather which had prevailed there during the latter part of January was very slow in dissipating. After the 4th, the cyclone commenced to fill up. The remains of it passed over New Zealand as a complex trough of low pressure, which though shallow, was responsible between the 6th and 8th for a general rain, which was the best experienced during the month. The southerly wind which followed the depression on the 8th and 9th was very cold and boisterous. Conditions remained unsettled to the east and north until the 13th.

The second cyclone appeared on the central Queensland coast on the 20th and moved southward until, on the 24th, it had reached Tasmania. It there, like its predecessor, commenced to pass slowly eastward, at the same time filling up. A low-pressure trough lying in a north and south direction was left, however, over the Tasman Sea, and while it crossed the Dominion, between the 26th and 28th, fairly widespread rains fell. Each of these cyclones was preceded in the New Zealand area by a rather intense anticyclone.

In addition to the above-mentioned storms, moderate depressions passed between the 16th and 18th and the 20th and 21st respectively, but neither produced a great deal of rain.

RAINFALLS FOR FEBRUARY, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.	Total for Year to Date.	Average for Year to Date.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	5·59	14	1·62	3·50	5·80	7·44
Russell	3·51	11	1·10	2·99	5·13	6·24
Whangarei	3·42	16	0·90	3·87	6·83	7·80
Auckland	8·17	18	2·16	3·12	9·74	5·84
Hamilton	3·08	12	1·01	2·91	6·07	6·48
Rotorua	7·43	12	1·96	3·69	10·40	7·95
Kawhia	4·40	8	1·55	2·86	9·85	6·41
New Plymouth ..	1·80	8	0·60	3·79	7·94	7·98
Riversdale, Inglewood ..	2·41	6	0·82	6·03	8·02	13·54
Whangamomona ..	..	..	..	3·89	..	9·47
Hawera	3·61	8	1·99	2·40	7·37	5·91
Tairua	6·70	14	1·12	4·68	7·57	8·34
Tauranga	8·37	12	2·11	3·51	10·45	7·59
Maraehako Station, Opotiki	6·77	13	2·18	4·14	8·17	7·73
Gisborne	4·89	11	1·78	3·46	7·17	6·18
Taupo	8·38	10	2·73	2·74	10·40	6·11
Napier	6·97	12	2·40	2·78	9·90	5·71
Hastings	5·86	11	2·35	2·25	7·85	4·18
Whakarara Station ..	..	..	..	..	..	..
Taihape	5·20	11	1·70	2·19	7·60	5·39
Masterton	..	..	..	2·73	..	5·33
Patea	..	..	..	2·40	..	5·99
Wanganui	4·88	9	2·18	2·42	9·46	5·25
Foxton	2·76	8	1·02	2·07	4·93	4·21
Wellington	3·51	11	1·33	2·67	5·54	5·48
			South Island.			
Westport	1·05	8	0·33	5·35	11·35	13·55
Greymouth	2·23	9	0·50	6·21	10·96	15·38
Hokitika	3·60	12	0·94	7·19	11·80	17·26
Ross	4·71	10	1·26	8·90	16·86	21·30
Arthur's Pass ..	2·72	9	1·05	9·90	17·69	24·02
Okuru, South Westland	2·46	6	..	9·66	..	22·25
Collingwood	3·21	10	1·13	5·13	6·41	11·71
Nelson	2·37	10	1·43	2·63	3·11	5·44
Spring Creek, Blenheim	0·94	7	0·33	2·18	1·74	4·40
Hanmer Springs ..	4·29	9	1·22	3·20	11·71	7·10
Highfield, Waiau ..	1·52	8	0·51	2·60	6·87	5·58
Gore Bay	1·83	12	0·65	2·80	6·66	5·26
Christchurch	1·53	11	0·62	1·74	4·97	3·92
Timaru	1·42	6	0·55	1·84	8·64	4·11
Lambrook Station, Fairlie	2·27	6	0·79	1·81	6·86	4·24
Benmore Station, Clearburn	2·17	9	1·00	1·62	3·68	4·39
Oamaru	2·19	7	0·60	1·79	5·88	3·83
Queenstown	..	..	..	1·94	..	4·86
Clyde	2·18	8	0·76	1·06	3·86	2·91
Dunedin	2·74	9	0·86	2·73	7·82	6·16
Wendon	2·28	7	0·77	2·26	4·45	5·46
Gore	..	..	..	2·65	..	5·73
Invercargill	2·11	10	0·80	3·12	5·79	7·13
Puysegur Point ..	2·46	14	0·70	5·74	8·96	13·36
Half-moon Bay ..	..	..	..	4·08	..	8·90

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

CONCRETE FOOT-ROT RACE.

B. H. T., Little Pigeon Bay, Canterbury.

I should be glad if you would give me shape and dimensions of a good concrete foot-rot race for sheep.

The Live-stock Division :—

The foot-bath should be in the form of a trough, 12 ft long, 18 in wide, and 6 in. high, the rails being placed in such a position as to act as guides into the race If large numbers of sheep are to be treated a portion of the yard may be railed off and concreted, with the edges of the concrete raised a few inches to hold the solution

USE OF SILAGE.

M. W. N., Portage Road, New Lynn :—

How soon after making may silage be fed out from a concrete silo. If it is found unnecessary to continue until all used, should the weights or a cover be applied again ?

The Fields Division :—

It is usually considered that silage should be left a month before feeding out, but when, in cases of emergency, feeding-out is commenced almost immediately after ensiling no bad effects have been noticed In practice it is very seldom necessary to feed out before one month has elapsed, and so not much experience has been gained on that point If it is found necessary to continue until all is used, it will pay to apply a thin covering (about 6 in) of earth to seal the silage. Otherwise waste will occur from 1 ft or more in depth Weights, unless they make a complete seal from the air, would not be of much use.

RELATIVE VISION.

C. G. S. O'B., Murchison :—

Which has the longer vision, and also the most distinct, man, horse, or dog ?

The Live-stock Division :—

Man has undoubtedly the longest and most distinct vision when compared with dogs and horses, but not when compared with certain birds. The dog actually sees acutely at a very short distance and relies to a great extent on general movement and scent to recognize his master (for example) A horse has a different type of vision from man and the dog, and is therefore not good at judging distance, but, on the other hand, it sees more in a general way than does the dog One would place distinctness of vision in the order of man, dog, horse ; but length of vision as man, horse, and dog

TREATING HORSE'S "SEEDY TOE."

"XYZ," Fairlie :—

Can you advise me of a satisfactory method of curing a horse's hoof which is hollow ? The hock above is inflamed.

The Live-stock Division :—

The horse's hoof is affected with what is known as a seedy toe. This is a condition in which the wall of the hoof becomes separated from the underlying

sensitive structure. Although it is commonly situated at the toe it may occur at any part of the wall of the foot. Pressure of some sort is usually considered to be responsible for producing seedy toe, a very common cause being a tightly hammered back toe clip, but in some cases the cause is obscure. Treatment: The diseased horn should be pared away by means of a narrow-bladed knife, known as a searcher. When all the soft friable horn is removed swab out the cavity with strong tincture of iodine and then pack the cavity with tow soaked in Stockholm tar, keeping this in place by a leather sole fitted under the shoe. A blister applied to the hoof-head above the cavity often helps to stimulate the growth of new horn, but it must be remembered that a bad seedy toe requires attention for a considerable period. Keep the horse away from dirty wet places as much as possible, and repeat the dressing every three or four weeks.

MASS ARTIFICAL INSEMINATION.

A. M. W., Ngatapa, Gisborne :—

I read recently about the mass artificial fecundation of dairy cattle in Russia by which means one good bull serves up to two thousand cows per year; by means of thyroid extract it can be arranged that all the cows to be served are simultaneously on heat when the semen arrives; the percentage of calves produced being well over 90 per cent Can you tell me if (*a*) artificial insemination has ever been successfully carried out in New Zealand, and (*b*) where can thyroid extract be obtained, and how it is administered

The Live-stock Division :—

(*a*) Artificial insemination has been carried out successfully at Wallaceville on individual cases, but no mass production of œstrum has been attempted (*b*) Thyroid extract can be obtained from drug warehouses It is generally administered by mouth, being one of the few organic therapeutic substances which can be relied upon to act by way of the mouth. There is considerable doubt, however, as to its efficacy if one desires to bring all cows into œstrum at once.

CONTAGIOUS ABORTION TREATMENT.

B. N., Taradale :—

Last season I had a cow and a heifer that slipped their calves at seven months, the heifer went to the butcher and the cow I had washed out three times, once with corrosive sublimate and twice with Condy's fluid She is now in calf and gone five months. Kindly let me know what disinfectant to use to to prevent abortion To-day I have a heifer slipping her calf at six months. I enclose an alleged abortion cure. Is it worth while to try it ?

The Live-stock Division :—

Contagious abortion in cattle is a slow chronic inflammation of the membranes surrounding the unborn calf which eventually results in expulsion of the fœtus. One attack confers a certain degree of immunity Heifers on this account are more subject to the act of abortion as they have not developed any immunity. While the infection remains on the farm heifers are liable to contract the disease as soon as they become pregnant. In the absence, therefore, of complete eradication of the infection it is more advisable to retain the heifers in the herd than to dispose of same to the butcher. By retaining the heifers in the herd a certain amount of natural immunity is conferred by each attack. Complete eradication of the disease from a herd can be carried out by blood-testing and elimination of all reactors, and by blood-testing all animals prior to their introduction to the herd. Carbolic acid has been known and used over a long period of years both as a cure and preventive of contagious-abortion disease. I have no evidence that this antiseptic will either prevent or cure abortion. The evidence in the enclosed cutting is not convincing, as cows develop an immunity irrespective of being dosed with any antiseptic. The use of carbolic acid either as a cure or preventive cannot therefore be recommended.

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WINTON EXPERIMENTAL AND DEMONSTRATION FARM.

RECORD OF WORK FOR SEASON 1932-33.

A. STUART, Instructor in Agriculture, Fields Division, Invercargill

THE season of 1932-33 once again emphasized the fact that the management committee had encountered a particularly critical financial period for the change-over from sheep to dairy-farming. Butterfat actually sold during the year amounted to 8,504 lb. from forty-three cows, from which the butterfat per acre figures can be deduced as 93·45 lb.

In comparison with the previous year there has been a slight falling-off in production, due to seasonal conditions and lateness of calving, associated with the temporary sterility in evidence the season previous. The herd was not placed under group test last season, but this matter has been rectified for 1934, and in this connection it is pleasing to record an improvement in the test of the two- and three-year-old animals which have been reared at the area and sired by the purebred Friesian bull, "Dominion King Matador of Weraroa."

ROTATIONAL GRAZING INVESTIGATIONS.

The experiment originally laid down in September, 1928, was associated with an investigation into the merits or demerits of using sulphate of ammonia in addition to phosphate; and grazing returns and herd production were accurately recorded for each pair of fields since its inception. Particulars relating to the laying-down of this trial were recorded in the *New Zealand Journal of Agriculture*, Vol. 41, pp. 407-412. Last season the investigation was confined to three pairs of fields, Blocks 2A and 2B being ploughed early in the autumn, and Blocks 6A and 6B having been ploughed the autumn previous to provide supplementary feed. When the results are analysed a progressive reduction in the carrying-capacity and butterfat-production of the nitrogen fields is revealed. This has been accompanied by a reduction in the white clover content of the pasture and the gradual opening-up of the sward. In view of the above results, the continuous application of sulphate of ammonia to pasture season after season cannot be recommended in practice at Winton.

This season, as sulphate of ammonia has been thoroughly tried out on these trials, no further trials with nitrogen under the grazing system are being carried out; but grazing records are still being kept, and each field receiving nitrogen has been top-dressed with 2 cwt. per acre of carbonate of lime for each hundredweight of sulphate of ammonia it has received since 1928. The object of taking these records is to determine whether the differences in carrying-capacity between the phosphate and phosphate plus nitrogen fields were due to the acidifying effects of the sulphate of ammonia applied. At the same time, a reasonable test is provided for the uniformity of the fields for future trials, and also for providing an incentive to carry on the excellent pasture control achieved during previous seasons.

Swede Manurial Experiment.

In Block 9 a swede manurial trial was sown on the 1st November, 1932. The seed used was "Grandmaster," at the rate of 17½ oz. per acre sown on ridges 26 in apart. Treatments were as follows:—

1. Superphosphate 3 cwt.
2. Superphosphate 3 cwt. plus carbonate of lime 3 cwt.
3. Superphosphate 3 cwt. plus carbonate of lime 3 cwt. plus 30 per cent. potash salts 1 cwt.
4. Superphosphate 3 cwt. plus carbonate of lime 3 cwt. plus 30 per cent. potash salts 1 cwt. plus blood and bone 1 cwt.
5. Superphosphates 3 cwt. plus 30 per cent. potash 1 cwt.

In each treatment approximately five-sixths of the fertilizer was sown from the front box (below the seed), and one-sixth from the rear box (with the seed). The crop was weighed on the 21st July, 1933, and the summary of yields, supplied by the Crop Experimentalist, is as follows:—

Treatment per Acre.	Quantity actually sown, in Pounds.	Yield, in Tons per Acre.
1. Super 3 cwt.	340	57·0
2 Super 3 cwt plus lime 3 cwt.	624	54·8
3 Super 3 cwt plus lime 3 cwt. plus potash 1 cwt	861	58·6
4. Super 3 cwt. plus lime 3 cwt plus potash 1 cwt plus blood and bone 1 cwt.	954	60·0
5. Super 3 cwt. plus potash 1 cwt.	496	57·0

Each yield is the average of ten weighings of single rows each of which was 33 ft. in length. The only significant fact was that the yield of treatment No. 3 (super 3 cwt. plus lime 3 cwt. plus potash 1 cwt.) was significantly greater than that of treatment No. 2 (super 3 cwt. plus lime 3 cwt.). Other differences are not significant. The incidence of disease (club-root and dry-rot) was practically the same over all treatments

Swede Variety Trial.

In the same block as the above a variety trial, incorporating fourteen strains or varieties, was sown on the 31st October, 1932. Seeding was at the rate of 17½ oz. per acre, and a mixture of two parts of superphosphate and one part of blood and bone was sown at the rate of 3 cwt. per acre. The seed was ridged in drills 26 in. apart, and the

drills were rolled immediately after sowing. The crop was thinned by hand on the 20th December, 1932. Weights were taken on the 20th July, 1933, and the Crop Experimentalist supplies the following results :—

Variety.	Yield, in Tons per Acre.	Remarks.
SECTION A		
1. R 34	61·3	Significantly better than 3, 5, 6, and 7.
2. Picton	55·6	Significantly better than 6.
3. Imrie's Improved ..	52·5	
4. Number One	56·4	Significantly better than 5 and 6.
5. Bangholm (Ayr) ..	51·5	
6 Herning (Gore Selection)	47·7	
7. Sutton's Green Top ..	50·2	
SECTION B.		
8 Sensation	60·2	Significantly better than 9, 10, 11, 12, and 13
9. Bangholm (Price) ..	44·7	Significantly lower than remainder in Section B
10. Earliest of All ..	51·9	
11. Ne Plus Ultra ..	52·4	
12 Skirvings	54·4	
13. Defiance	51·9	
14. New Colossal Tipperary	57·1	Significantly better than 13.

On account of the layout of the trial, varieties in Section A are not comparable with those in Section B.

TURNIP VARIETY TRIAL.

In Block 3 a turnip variety trial was laid down, but owing to a serious club-root attack it was fed off at an early stage by a line of 150 lambs purchased for this purpose.

The other trial of interest was in connection with the Bruce turnip, an account of which has already been published in the *New Zealand Journal of Agriculture*, Vol. 47, pp. 297-301. Some three hundred selected bulbs have been transplanted and will be saved for seed this season.

OTHER CRUCIFEROUS TRIALS.

In Block 6, which was mainly sown to chou moellier for autumn and early-winter feeding of the dairy herd, two small trials were of interest. Small blocks of rape kale (early type), buda kale (rape type), buda kale (cabbage type), and Maori cabbage were sown out on land known to be infected with club-root. It was noted that the Maori cabbage developed club-root very severely, but its growth was not interfered with to a great extent. On a neighbouring farm, where an acre of each was sown and fed off, twenty-one lambs were placed on each block on 8th April, 1933, and on 11th May, 1933, the lambs were drafted as follows : Maori cabbage, 21 fat ; buda kale rape type, 21 fat ; buda kale cabbage type, 20 fat (1 not quite prime) ; rape kale early type, 19 fat (2 left).

From this it will be seen that Maori cabbage stood up very well in comparison with buda kale, although the lambs produced on the Maori cabbage were lighter than those produced on kale blocks.

Source of Seed-potato Trials.

In conjunction with ten other farms in the South Island, a certified Dakota crop was grown last season at Winton. The crop weighed as follows: Table, 6·2 tons per acre; seed, 1·6; small, 1·6: total, 9·4 tons per acre.

This yield places Winton fifth equal on the list. A bag of seed produced from each centre is being grown this year at a central yield trial at Rangiora A further area has again been sown at each local centre.

In previous years the variety Arran Chief had been used, and it had been established that under colder conditions and in isolated areas generally there is less incidence of aphides and consequent spread of virus disease. Southland, amongst favoured localities, should therefore be looked to for seed by other provinces as Scotland is looked to by English growers.

Grass and Clover Strain Trial.

The two hundred cocksfoot and red and white clover plots laid down in Field 5 have not afforded much interest, except that the certified mother white clover strain (more generally known as New Zealand No. 1) is an outstanding clover for production of herbage. Montgomery red clover has also shown fair persistency under grazing conditions. The cocksfoots, with the exception of the Plains and Akaroa strains, have not proved an unqualified success when sown in competition with the rye-grass base used.

The corresponding rye-grass trials in Field 7 present evidence as to the persistency of the certified type, but they have also provoked controversy as to whether persistency can be influenced by palatability or close grazing. To throw further light on this question Block 6 has been sown out, one-half with certified rye-grass and the other half with a mixture of five commercial local lines With both lines, white clover was included. Grazing and production records will be kept in conjunction with the rotational grazing records.

Effect of Nitrogen on Young Pasture.

Block 13, sown down in November, 1931, with certified rye-grass, timothy, crested dogstail, red and white clover, together with 2½ bushels of oats (which were later cut for hay), was top-dressed in the following March with 2½ cwt. per acre of superphosphate. On the 10th September, 1932, strips were top-dressed across the width of the field with 4 cwt., 2 cwt., and 1 cwt. per acre of sulphate of ammonia. From the outset a decided stimulation of the rye-grass occurred, with the consequent reduction of the clover content. At the present time, even after two cuts of hay have been taken, the 4 cwt. strip can be clearly distinguished, although the 2 cwt. and 1 cwt. strips now closely approximate in composition the remainder of the field, which is clover dominant.

A peculiar feature this spring was that this 4 cwt. strip of dominant rye-grass was the only part of the paddock severely attacked by *Porina* and grass-grub. As a consequence, growth has not been so heavy on this strip.

On this block a rate of liming trial was laid down this spring, carbonate of lime being applied at 1 ton, 2 tons, and 4 tons per acre these strips crossing the sulphate of ammonia strips.

GENERAL.

The laying-down to permanent pasture of Block 15 has improved the appearance of the area greatly, but there is still need of further shelter.

Material financial assistance has been provided by the trustees of the R. M. MacKinnon Estate, as in past years, and the committee wishes to place on record its appreciation of this valuable aid.

Favourable mention is accorded to the farm manager (Mr. G. L. Smart) for the manner in which the committee's programme of work has been carried out under the popular chairmanship of Mr. D. H. McLean, Caroline.

THE RELATION BETWEEN FAULTY WINTER FEEDING OF EWES AND THE SUSCEPTIBILITY OF THEIR LAMBS TO PULPY KIDNEY.

A LESLIE, Veterinary Department, Canterbury Agricultural College, Lincoln.

[The following is a report of research work at present in progress at Canterbury Agricultural College It should be noted that finality has not been reached and further research is being conducted —THE AUTHOR.]

ALTHOUGH the essential pathology of entero-toxæmia (pulpy kidney) in lambs was considerably advanced by the tracing of the ultimate cause to a bacterial toxin(s), Koch's postulates remained unsatisfied and further investigation was rendered necessary(1), (2), (3).

A large-scale experiment with over eight hundred ewes and their progeny was therefore begun in 1932 on a Canterbury plains farm where pulpy kidney occurs. The husbandry conditions, soil, and climate have been described in a previous issue of this *Journal*(4). It was also shown that feeding conditions for about eight months of the year from January till August were generally poor. In 1933 a very dry summer and the consequent failure of the root crop resulted in an even more severe shortage of feed up to lambing than occurred in 1932. In what follows therefore an appreciation of the cumulative undernutrition to which the experimental sheep have been subjected is most important. The long periods during which the flock was necessarily fed on poor pasture, green oats, oat-sheaf chaff, and turnips should be sufficient indication that not only quantitative but also qualitative undernutrition, especially with respect to minerals and protein, was serious.

VALIDITY OF USING LIVE-WEIGHTS AS A MEASURE OF NUTRITION.

Ewes and lambs were ear-tagged or tattooed and weighed periodically. A record of body-weights has thus been secured, which, used as a measure of nutrition, provides evidence to implicate faulty preparturient dieting of the ewe as a factor predisposing the lamb to pulpy kidney.

The use of live weights as a measure of the quality and quantity of feed is open to the objection that phenomena of etiological importance which are detectable by immunological and biochemical methods may not be reflected in changes of body-weight. There is the possibility, for example, that the crossbred nature of the lambs (Romney and English and Border Leicester ewes × Southdown rams) might

have some effect on their resistance to disease. Further, when there are only small differences in the feeding of different groups of animals, individual variations may effectively prevent any noticeable change in relative weights between such groups. Although these considerations apply to the experiments discussed here, the data derived from them is suggestive and recorded for the benefit of those interested in the disease.

Field Observations in Canterbury, and their Interpretation.

Extensive field-work in 1931–32(5) indicated that a correlation existed between the nutritional condition of ewes at lambing and the susceptibility of the offspring to "wool-ball," pulpy kidney, &c. It was found that the incidence was highest among the offspring of ewes wintered on poor pasture which showed little green growth before lambing and in flocks receiving an abundance of roots over a long period without supplementary feed. Investigations(6) into the etiology and prevention of ante-partum paralysis of twin-bearing ewes showed also that, where improved dietary conditions prevented ante-partum paralysis, the incidence of "wool-ball," pulpy kidney, and lamb mortality at birth noticeably decreased.

Experience during the lambing season of 1933–34 confirms that of previous years, and it is suggested that the following data indicate that faulty feeding of pregnant ewes adversely affects the nutritional (immunological ?) status of the newborn lambs and renders then less able to resist the disease.

Detailed Histories of Six Cases of Pulpy Kidney.

Changes in body-weight from March till August in 1932 and in 1933 of six ewes whose lambs died of pulpy kidney in 1933 are discussed herein. Although similar results were obtained in 1932, the microscopic and biological diagnoses which have been kindly undertaken this year by Mr. D. A. Gill, Wallaceville Veterinary Laboratory, Wellington, and in his absence by Mr. C. S. M. Hopkirk, Officer in charge, were not made. To avoid the possibility of inaccurate macroscopic diagnoses, details only of positive cases in 1933 are given, and these are limited to those ewes which possess histories for two years.

The following table sets out in pounds the body-weights of the six ewes referred to below.

Ewe No.	Year.	Mar.	May.	June.	July.	Aug.
1254	1932	101	91	89	99	113
	1933	91	..	88	90	91
212	1932	110	104	120	132	131
	1933	112	..	118	115	114
762	1932	81	82	90	92	100
	1933	86	83	78	..	88
315	1932	96	93	108	114	116
	1933	116	..	93	..	94
718	1932	79	87	92	95	98
	1933	77	..	79	..	86
474	1932	98	97	117	122	122
	1933	106	..	91	..	91
Dry ewes	1932	90	89	..	101	103
	1933	104	96	90	..	88

The March weighings were made just before tupping and the August weighings just before lambing. The ewes showed a somewhat better condition in 1932, but the plane of nutrition is considered to be low in both years and characteristic of the class of land in Canterbury.

The histories of the cases in some detail are :—

CASE NO. 1: EWE NO. 1254. ENGLISH LEICESTER CROSS, FULL-MOUTHED.

1932. Fleece-weight, 6·5 lb ; body-weight, 1st November, 1932, 102 lb. ; lambed 26th September, 1932, male, birth weight, 11 lb, growth-rate per day, 0·53 lb (healthy).

1933 Fleece-weight, 5·4 lb, body-weight, 15th November, 1933, 89 lb ; lambed 1st September, 1933, male twins, birth weight, 6·3 lb. and 5·5 lb (dead, pulpy kidney) ; growth-rate to death, 0·304 lb. per day ; days old at death, 14 Uncastrated.

Comment —In spite of the fact that she was 19 lb. lighter at lambing in 1933, this ewe produced twins of a total birth weight of 11·8 lb During the critical part of her gestation period, dry ewes failed to maintain their weight under the same husbandry and feeding conditions. Pregnant ewes must therefore have had to draw on their own body reserves to nourish their offspring. As a result of the drought from January to June, 1933, before winter feeding started these reserves could have been but poorly built up on a diet deficient minerally and otherwise.

The growth-rates of lambs which are given in this and the following comments are comparable, and extend over the pulpy-kidney period

CASE NO. 2: EWE NO 212 BORDER LEICESTER, EIGHT-TOOTH

1932. Fleece-weight, 5·9 lb ; body-weight, 19th December, 1932, 123 lb ; lambed 30th August, 1932, single, 9½ lb, growth-rate per day, 0·62 lb. (healthy).

1933 Fleece-weight, 4·8 lb, body-weight, 15th November, 1933, 118 lb, lambed 8th September, 1933, male twins ; birth weight, 6·1 lb. and 4·5 lb (dead, pulpy kidney), live-weight increase per day to death, 0·388 lb, days old, 9. Uncastrated

Comments — The above data show, as in other ewes referred to, that the wool yield is less in 1933 than 1932. Shearing took place in November This is in keeping with drought conditions, which also reduced fertility and increased the percentage of dry ewes. This ewe increased 28 lb in body-weight from May to August in 1932, but in 1933, although about the same weight at mating, she weighed approximately the same weight before lambing twins The mortality among twins, their growth-rates, and the unsuitability of the dietary conditions on this farm for economic twin production will be dealt with later

CASE NO 3: EWE NO 762. ROMNEY CROSS, SIX TO EIGHT TOOTH.

1932. Fleece-weight, 7·8 lb. ; body-weight, 19th December, 1932, 86 lb. ; lambed 7th September, 1932, single, 9½ lb. ; live-weight increase per day, 0·46 lb (healthy).

1933. Fleece-weight, 7·1 lb. ; body-weight, 16th December, 1933, 95 lb ; lambed 29th August, 1933 ; single, 8·3 lb. ; live-weight increase per day, 0·513 lb. to tailing, two days before death.

Comment.—As a two-tooth in 1932 this ewe should have begun her second pregnancy with a greater body-weight than she had during her first. Other two-tooth ewes which did not bear a lamb in 1932 and were run with the in-lamb ewes did show an average increase of 24·7 lb. from March, 1932, to March, 1933. The average increase for two-tooths that produced lambs was 7·6 lb. The plane of nutrition in 1932 was therefore not high enough for this two-tooth ewe to produce a lamb, 7·8 lb. of wool, and put on more than 6 lb. of body-weight. Elsewhere(4) we have noted that the teeth of the above dry two-tooth ewes were sounder than those that produced offspring in addition to wool.

CASE NO. 4: EWE NO. 315. ROMNEY CROSS, SIX TO EIGHT TOOTH.

1932. Fleece-weight, 6·7 lb. ; body-weight, 19th December, 1932, 122 lb ; lambed 26th September, 1932 ; single, 9 lb. ; live-weight increase per day, 0·53 lb. (healthy).

1933. Fleece-weight, 6 lb. ; body-weight, 15th November, 1933, 116 lb. ; lambed, 20th August, 1933 ; single, 7·6 lb. ; live-weight increase per day, 0·45 lb. to death at eighteen days old.

Comment.—Just before lambing this ewe was 20 lb lighter than she was at the same time the previous year. In this case, as in case No 6, the record of body-weights indicates very poor preparturient dieting

CASE NO. 5 EWE NO. 718. ROMNEY CROSS, SIX TO EIGHT TOOTH.

1932. Fleece-weight, 8·4 lb.; body-weight, 19th December, 1932, 88 lb.; lambed, 10th September, 1932; single, 9 lb; live-weight increase per day, 0·47 lb. (healthy)

1933. Fleece-weight, 5·8 lb; body-weight, 15th November, 1933, 96 lb.; lambed, 9th September, 1933; single, 9·4 lb.; live-weight increase per day, 0·624 lb. to death, nineteen days old

Comment—Possibly this ewe is still showing the effect of lamb-production in 1932 when she was a two-tooth (see comments under case No 3). The live-weight increases per day of the lambs succumbing in 1933 (see notes for cases Nos. 3 and 5) are greater than those of the offspring of the same ewes in 1932 in spite of the poorer condition of the dams. This may be partly due to the fact that on this farm the offspring of two-tooths make slower growth than the progeny of more mature ewes (unpublished data)

CASE NO 6 EWE NO. 474. CROSSBRED, FAILING MOUTH

1932 Fleece weight, 7·1 lb.; body-weight, 19th December, 1933, 112 lb. lambed, 31st August, 1932; single, 10½ lb, live-weight increase per day, 0·57 lb. (healthy)

1933. Fleece-weight, 6·3 lb.; body-weight, 15th November, 1933, 100 lb.; lambed, 15th September, 1932; single, 9 lb, live-weight increase per day, 0·477 lb. to marking and 0·427 lb to death, when thirty-four days old Death occurred nineteen days after castration

Comments Case No 6 is similar to case No. 4, and shows that the ewe is on the down grade before lambing In an examination of over 1,500 ewe records we have not encountered pulpy kidney in the offspring when the converse has been well marked.

The records of the average body-weights of the dry ewes in 1932 and 1933, run under the same conditions as the in-lamb stock, show that the 1933 dry ewes lost weight from mating to lambing and, during the winter period, which coincides with the critical part of the gestation period, barely maintained themselves It is noteworthy, moreover, that the 1932 dry ewes more than made good during the spring and early summer and commenced the next conception period at much higher weights (see comments under case No 3). The fact that dry ewes build themselves up during the lactation period of the flock may apply equally to ewes losing their lambs soon after birth, and may explain why they may not lose their lambs from pulpy kidney in successive seasons.

FURTHER EVIDENCE FOR THE SUGGESTION THAT FAULTY FEEDING OF PREGNANT EWES PREDISPOSES LAMBS TO PULPY KIDNEY.

(*a*) *Time of Lambing.*—In 1932 it was found on our experimental farm that the incidence of lamb-mortality from pulpy kidney, wool-ball, &c., was highest in the offspring of early lambers that had less chance of picking up on green spring growth than the late lambers in the same flock which benefited considerably from natural green herbage. In the same year it was found also that as the birth weights of lambs increased with later lambing the mortality from all causes decreased. In 1933, to show that ewes improved in condition as lambing proceeded, body-weights were recorded about the middle of the season and showed increases varying from 15 lb. to 20 lb., during the previous month. This increase coincided with the supply of spring herbage.

(*b*) *Birth Weight of Lambs.*—It has not been possible to correlate birth weight with susceptibility. The explanation of this may be in the inability of a balance to distinguish between size and constitution. The size of a lamb at birth may give no idea at all of the nutritional status with regard to disease resistance. In

other words, large lambs do not necessarily possess better powers of resistance than smaller lambs. It is conceivable, moreover, that large single lambs would show the effects of faulty intra-uterine nutrition more than small ones and not much less than twins, which will be shown later to be more susceptible than singles.

The increase in birth weight which accompanies later lambing is, of course, a different matter.

(c) *Percentage of Lambs born Dead, or dying within Three Days.*—Under some circumstances a diminution of losses from diseases may be associated with earlier or later lambing or with a particular season. Since it is possible that the mortality at birth has a direct influence on the number of potential pulpy-kidney cases this association may be partly explained by the circumstances determining losses at birth or soon after. Experimental evidence here(7) and elsewhere(8) supports this contention, and consequently the calculation of the number of deaths occurring two, four, and eight weeks after lambing should be qualified by the number of deaths at birth or soon after. For example, lamb-mortality at birth may be high and the incidence of pulpy kidney low in one season, whereas the converse may be true in another. Annual and seasonal variations in the quality and quantity of the feed are probably closely related to this distribution of lamb losses In support of this we find that in 1932 10 per cent. of twins died within three days of birth from obscure causes, probably nutritional in origin, and another 5 per cent. died during the pulpy-kidney season. In 1933 the corresponding percentage losses were 5·7 per cent. and 7·7 per cent. The mortality among singles in 1932 and 1933 from obscure non-specific causes was 7·5 per cent. and 1·8 per cent. respectively up to the third day after birth. Total losses from then till the end of the pulpy-kidney season amounted to 4·2 per cent. and 2·3 per cent. respectively.

(d) *Susceptibility of Twins.*—Of twelve positive biological tests for pulpy kidney three were made on twins—that is, 25 per cent. Apart from the fact that 5·7 per cent. of the thirty-five sets of twins and only 1·8 per cent. of the singles died within three days of birth, 25 per cent. of the losses from pulpy kidney occurred among twins surviving the three-day period, although there were at least ten times as many single lambs. The higher susceptibility of twins is thus illustrated. Twins reared as twins show only 77 per cent. of the growth rate of singles reared on mature ewes, and under husbandry conditions unsuitable for twin production this poor thrift must have considerable etiological significance.

(e) *Milk-production of Ewes.*—Excessive milk consumption has been suggested as a factor predisposing to pulpy kidney, but no experimental evidence in support of such a contention is available(2). Post-mortem examinations have revealed masses of milk-clots in the abomasum of lambs dead of pulpy kidney, but these may be an effect and not a cause. In this connection it is interesting to note that in 1932, and again in 1933, all twin lambs reared as singles on foster mothers remained healthy and showed good growth gains in spite of low birth weights; 5·3 per cent. and 4 per cent. respectively were transferred. In our experimental flock, pulpy kidney was confined to twins reared as twins, one or both succumbing, or to one member of a pair reared on its own mother, the other member having died at birth. It may be noted

in this connection that we have evidence to show that the production of twin lambs under our conditions, by causing an extra drain on the ewe, has the effect of reducing the milk yield below that of ewes producing singles. Greater milk consumption, therefore, would seem to be a preventive for pulpy kidney rather than a precipitant, as none of the transfers died. It is contrary to the hypothesis that high milk consumption is predisposing, and suggests that either faulty intra-uterine nutrition and low milk yield or both are factors of prime etiological significance in susceptibility to pulpy kidney.

(*f*) *Feeding and the Composition of Milk.*—The chemical composition of ewes' milk as opposed to its biological (immunologic ?) value is practically fixed for all feeding conditions; the quantity mostly is affected by under- or mal-nutrition(9). Since the milk is a complete food, a lamb born under certain deficiencies may make them good by high milk consumption. It may later have access to suitable green feed which would be similarly useful, but if neither sufficient milk nor green feed is available then congenital deficiencies may lead to susceptibility to disease.

Apart from the inherited qualities and nutritional status possessed by new-born lambs, it can be stated with a good deal of authority that the greatest impetus to health and growth in young lambs is largely received from the nourishment provided by the dam—that is, the offspring of good milking-ewes grow more quickly than lambs born of ewes possessing low milking-powers. In the light of what has been said, the growth gains of lambs dying of pulpy kidney become of interest. Calculations of growth rates based on the birth weight, age in days, and the dead weight of the lamb, without weighings in between, are open to the criticism that dependence is placed on dead weight and does not allow for inhibition of growth due to unnoticeable indisposition before death, if such occurs.

(*g*) *Growth-rates of Lambs dying of Pulpy Kidney.*—In five out of six cases diagnosed biologically body-weights were recorded some time before and again after death. The results show that lambs developing pulpy kidney were slow thrivers. In addition, when the growth-rate of lambs dead of pulpy kidney were compared with the average gains of twenty lambs of the same birth weight and sex, and born within eight days of the lambs that died, it was found that in no case did the growth-rates of the pulpy-kidney lambs (measured in pounds per day) exceed that of like individuals reared under the same conditions. These findings lend support to the view that faulty prenatal nutrition and low milk consumption are factors of predisposition. If these deductions are correct, it is conceivable that lambs which are potential pulpy-kidney cases at birth may become nonsusceptible by high milk consumption in early life. The good progress made by all twins reared on foster mothers in 1932 and 1933 supports such a contention.

(*h*) *Ingestion of Foreign Substances.*—The tendency of the new-born lamb to nibble at and ingest foods and substances beyond its powers of digestion, and therefore inimical to normal digestion, commonly accompanies pulpy-kidney disease, but the agencies responsible for this form of pica or depraved appetite are imperfectly understood. A two-day observation in 1931 on two flocks of young lambs born of well and of poorly nourished dams revealed information which suggests that the offspring of poorly nourished ewes are more prone to premature ingestion of foreign matter than those of well nourished high milkers.

The amount and quality of herbage available to the lambs did not seem to influence the position. From these observations and other data(10) it is held that the premature consumption of foreign substances by young lambs is a deliberate attempt on their part to balance up their nutritional status, improverished by faulty intra-uterine nutrition, and uncorrected by the milk yield of the dam. The connection between this and other secondary agencies altering the environment of the causal organism or organisms(5) in the alimentary canal and causing it to become virulent is outside the scope of this paper. Further work embracing a study of the effects of an inadequacy of the various food ingredients and their effect on the immunologic mechanism of the new born seems a promising line of attack for future investigations.

Discussion.

The reported appearance of the disease under very diverse dietary and husbandry conditions and the paucity of experimental evidence concerned with factors of predisposition are no doubt responsible for the numerous hypotheses of predisposition and also for the few measures of prevention recommended.

From the data presented it is difficult to overlook the obvious part that a diet barely capable of maintaining the body-weight of dry stock can have on twin producers, on two-tooth ewes carrying their first offspring and presumably still growing, and on adult ewes whose constitutions are subjected to considerable fluctuations in nutrition from year to year and probably depleted through production.

It is found, with Gill and Hopkirk(2), that docking and castration precipitate the disease in susceptible flocks and, as a consequence, tailing and castration when lambs are better grown is recommended. It would seem, however, that the not infrequent higher incidence of females succumbing to pulpy kidney after docking is due to the greater mortality among males earlier in life, in addition to ante and post natal nutritional influences. In the experiments in 1933 the greater loss of males at and within three days of birth was in the ratio of two males to one female. The finding regarding greater mortality among males at or soon after birth and its possible connection with the incidence of disease is in harmony with observations on other animals(11), (12).

Summary.

In a preliminary report on the factors predisposing young lambs to entero-toxæmia (pulpy kidney) evidence is brought forward to implicate faulty feeding of the dam as one factor.

A comparison between body-weights of in-lamb ewes and dry ewes has been employed in a study of the effects of reproduction under the particular conditions of the experiments.

Faulty maternal nutrition is believed to operate in two ways: (*a*) By causing impoverishment of the nutritional status of the new born, and (*b*) by lowering the milk yield of the dam.

Etiological significance is attached to the higher susceptibility of twins and the importance of a knowledge of lamb-mortality at birth and differential sex mortality are stressed.

Live-weight increase per day is used to study the growth-rate of lambs. It has been shown that susceptibility and slow growth are closely associated. The ingestion of foreign substances is considered to be secondary to faulty prenatal nutrition and poor milk-production.

Evidence is advanced to show that a correlation exists between the time of lambing and susceptibility to pulpy-kidney disease and other conditions in so far as lambs born of ewes that had reached a low plane of nutrition at lambing were far more susceptible to disease than better-nourished lambs born three to four weeks later of a similar class of ewe that had access to green spring growth for some time before lambing.

No conclusions are drawn regarding the particular deficiencies leading to faulty preparturient dieting on this farm, but it is noteworthy that rapid decay of the teeth is common, breeding efficiency is low, and that natural growth meets the food requirements of the flock for about four months of the year only.

Based on the above findings, improved dieting of in-lamb ewes is suggested as one preventive for pulpy-kidney disease.

ACKNOWLEDGMENTS.

It is a pleasure to make the following acknowledgments: To the New Zealand Meat Producers' Board which, with the assistance of various Canterbury agricultural and pastoral associations, the Canterbury Sheep-owners' Union, the Sheep Breeders' Association, various branches of the North Canterbury Branch of the New Zealand Farmers' Union, defrayed much of the expenditure incurred in the investigation; to Messrs. Gill and Hopkirk, of the Wallaceville Veterinary Laboratory, who kindly undertook the diagnoses and gave other assistance; to Mr. H. P. Donald, B.Sc., M.Agr.Sc., for assistance at various times; to Mr. Hines, the farm-manager on the experimental property; and to Mr. J. Linton for assistance during shearing and at other times.

In conclusion, I wish to record the fact that Mr. J. W. Mclean, B.Agr.Sc., assisted largely in the experiments upon which the deductions are based. He has devoted much time to the interpretation of the records, and, in addition to the field-work, has been of valuable assistance in compiling this report.

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THE NEW ZEALAND ARMY WORM.

J. MUGGERIDGE, Entomologist, Plant Research Station, Palmerston North

AN outbreak of destructive caterpillars in the Ashburton County in October of 1933 was due to *Persectania ewingi* Wwd. *(P. composita, Melanchra composita)*, more commonly referred to as the New Zealand army worm. The word "worm" in this respect is incorrect, and the only ground justifying its retention is the matter of long usage. A better common name to apply to the pest would be New Zealand army caterpillar, as the insect concerned is a typical moth larva. Other caterpillars commonly associated with *P. ewingi* are *Cirphis unipunctata* Haw. and *Heliothis obsoleta* Fabr., but only *P. ewingi* will be considered here, as it is the one mainly responsible for the outbreak. It passes through four typical stages in its life-history—viz., egg, larva or caterpillar, pupa or chrysalis, and finally adult or imago.

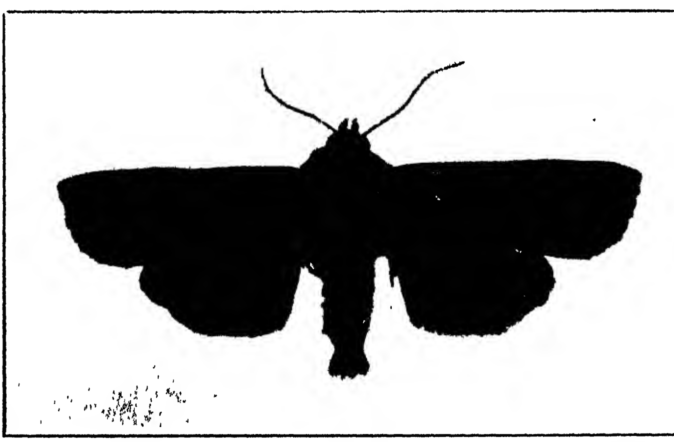

FIG. 1. THE ADULT INSECT, OR MOTH, OF THE NEW ZEALAND ARMY WORM.

The Adult.—The adult insect (Fig. 1) is a moth, the body of which has a short, thick-set appearance with a wing expanse of about 1½ in. The forewings are irregularly streaked with white, while the hind wings are an even dark to light-brown shade. It is a night-flying species, and rests during the day among grasses and on posts and trees, &c. This stage of the insect is the reproductive and distributive phase. The adult insect is short-lived and depends for its nourishment on the nectar of flowers. It is strongly attracted by light, and hence it is one of the commonest species found flying around lights at certain seasons of the year.

The Egg.—The eggs are very tiny objects, and are commonly laid on or amongst weeds, grass, or stubble. Several hundreds are deposited by a single female.

The Larva.—The larval or caterpillar stage (Fig. 2) is the stage in which the insect grows and feeds, and it is in this period of its life-cycle that it attracts most attention on account of its occasional serious

attacks on farmers' crops. The young larva on first hatching from the egg is very small and is not readily seen, but with subsequent feeding it soon develops into a comparatively large caterpillar measuring up

FIG 2 THE LARVA, OR CATERPILLAR, OF THE NEW ZEALAND ARMY WORM

to 1½ in. or more in length. The colour of the larva is variable. Hudson (1928) describes it as bright reddish-brown ; there is a broad, black, dorsal stripe, and dull-red, white, and black lateral lines. When disturbed the caterpillars curl up in hoop-like fashion. When not feeding they lie hidden under debris or under clumps of earth.

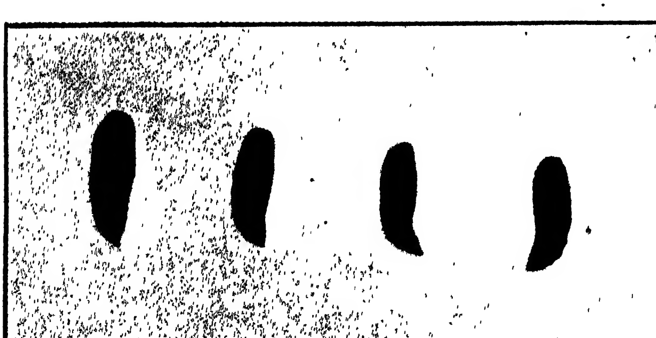

FIG. 3. PUPAE OF THE NEW ZEALAND ARMY WORM.

The Pupa.—The reddish-brown pupal stage (Fig. 3) into which the caterpillar changes is the resting and transformative stage during which no nourishment is taken. Adult characteristics are acquired prior to the emergence of the adult moth. Pupation usually takes place beneath clods of earth and amongst the debris, &c., in the field.

P. ewingi occurs in Australia and Tasmania, as well as in New Zealand, and occasionally proves a pest in the former countries as it does here. Its life-history in New Zealand is but imperfectly known,

though it is usually referred to as being double-brooded, while in Australia it is described as single-brooded. In Australia eggs laid in autumn reach the pupal stage about September; from the pupal stage the adult moth emerges during the following autumn. In New Zealand the spring pupal stage lasts but a short time before the adult insect emerges, so that by the following autumn a further cycle from egg to adult is completed. The natural food of the *P. ewingi* is native grasses, but it has quickly adapted itself to imported plants, and takes readily to cereal crops to which at times it does considerable damage.

The marching habit of the pest is due to the fact that enormous numbers of larvæ are present in a limited area in which all available food is soon exhausted, so that they are forced to migrate in search of further sustenance, sometimes in hordes like an army on the march.

The reasons for an outbreak of army worms are problematical. Normally insect parasites must be largely responsible for checking undue increase of the worms, and it seems certain, therefore, that spasmodic outbreaks of the kind recently experienced are largely due to a fundamental disturbance of the host-parasite relationship, permitting a rapid multiplication of the host with a consequent relative decrease of parasites.

Other natural checks include bacterial and fungous diseases, and birds. Normally, disease probably plays a small part in keeping the pests in check, though it may prove a valuable ally in helping to exterminate them when they are assembled in large numbers. The value of birds in helping to maintain the normal balance is little understood, though birds that are chiefly insectivorous should undoubtedly be encouraged.

CONTROL.

When the caterpillars are on the march a useful method in helping to check them is to plough a deep clean furrow across their line of advance. The furrow should be cut with the steep side nearest the crop it is intended to save. Veitch (1933) states that the best procedure in applying this method is to open the furrow, throwing the loose earth towards the area to be protected, a return furrow can then be cut into this leaving a line of loose earth above a steep face. The final shaping of the trench formed can be completed with a spade. Small vertical-sided pits should be sunk in the furrow at distances of 20 ft. to 50 ft. or more; into these the roaming caterpillars will readily fall, and may there be disposed of by means of pounding with a piece of timber or ram-rod. In connection with the furrow method of checking an advance, the use of poisoned baits should be resorted to. In the case of an outbreak of the caterpillars in a standing crop, the poison bait method is really the only suitable method of control to adopt. A mixture most commonly recommended consists of 25 lb. of bran; 1 lb. of one of the following: Paris green, sodium fluoride, sodium arsenite, white arsenic; molasses 1 to 2 quarts. To prepare, the poison and bran should be mixed in a dry condition and stirred very thoroughly to ensure an even distribution. The molasses should be dissolved in about 2 gallons of water which is then added gradually to the bran until the mixture is thoroughly damped but not too wet. It should be moistened sufficiently to have the consistency of a crumbly mash. Where sodium arsenite or sodium fluoride is used it is advisable that it be dissolved in the water to which the molasses is subsequently

added, and the whole then poured on to the requisite amount of bran, taking care as before to avoid making it too moist. The quantity of mixture required depends on the density of the infestation. In a light infestation, 8 lb. to 10 lb. of the bait per acre scattered at dusk should be sufficient, though in dealing with a heavy attack 40 lb. to 50 lb. to the acre may be necessary. The material should be broadcasted in the late evening or at dusk, as if distributed in the daytime it tends to dry out and is far less palatable to the caterpillers. Great care must be exercised in the preparation of these baits as the poisons used are extremely dangerous. To avoid inhaling the dust it is advisable to tie a handkerchief over the nose and mouth during mixing operations. Again, it is unwise to allow the poison to come in contact with the skin, though in broadcasting operations this is unavoidable. But thoroughly washing the hands and arms in a plentiful supply of fresh water will obviate any risks from its use.

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FERTILIZER IMPORTATIONS: DECEMBER QUARTER.

FOLLOWING are particulars (in tons) of fertilizers imported into New Zealand during the three months ended December, 1933 *Rock phosphate* · Nauru/Ocean Islands, 41,686. *Phosphatic guano or soft phosphate*. Seychelles Islands, 11,317; Madagascar, 3,658; New Caledonia, 527, United Kingdom, 5 *Other phosphates* Egypt, 350 *Kainit:* France, 5, Germany, 60. *Muriate of potash:* France, 15; Germany, 20. *Sulphate of potash* France, 110; Germany, 135. *Other Potash fertilizers:* France, 198, Germany, 246, Netherlands, 1; Spain, 100 *Sulphate of ammonia:* United Kingdom, 455; Canada, 100. *Nitrate of soda:* Chile, 165. *Other fertilizers*. United Kingdom, 1 cwt, Germany, 20 cwt.

FARM PRODUCTION, 1932 33.

THE following information relative to farm production has been compiled by the Census and Statistics Office: -

The value of agricultural production in 1932–33 (£8,900,000) shows an increase of £900,000, or approximately 11 per cent, as compared with 1931-32. The wheat harvest of 1932–33 totalled 11,000,000 bushels as compared with the abnormally low figure of 6,500,000 bushels in the previous season; so that, notwithstanding a decrease in prices, the total value of the wheat crop increased. Increases in the yield of other important crops, notably oats, were also recorded.

Pastoral production during the 1932–33 season is valued at £20,400,000, an increase of 5·7 per cent. over the exceptionally low figure recorded in 1931–32. The volume of wool production increased from 282,800,000 lb. in 1931-32 to 288,400,000 lb. in 1932-33, while production and exports of beef, lamb, and pork were in excess of the totals for the preceding year. Prices of both wool and meat remained at extremely low levels during the season, the recovery in prices at present in progress commencing practically at the close of last production year.

The value of dairy production was practically the same as in the previous year, a considerably increased volume of butter and cheese production counteracting the effect of a fall in prices as compared with 1931–32.

The total value represented by the three groups of farm production was £52,500,000, as compared with £50,400,000 in 1931–32 and £83,400,000 in the peak year (1928-29).

CONTROL OF ORCHARD DISEASES AND PESTS BY SPRAYING.

Horticulture Division.

THE commercial fruitgrowing areas of New Zealand show wide differences in climatic conditions, vigour of trees, and susceptibility of varieties to disease. For this reason it is not possible to present an orchard-spraying programme which will be applicable throughout, and the recommendations here given may require modification to meet local requirements.

Recent investigations conducted at the Plant Research Station, Palmerston North, have so increased our knowledge concerning the physical and chemical properties of sprays, and their application, that very material alterations in our orchard-spraying programme have become necessary. The time is therefore opportune for publication of a statement of our current knowledge of the practice of spraying.

There is a distinct trend on the part of overseas manufacturers to bring forward numerous new brands of orchard sprays or spraying materials. These should be regarded with caution until their efficacy has been demonstrated.

Sprays to use.

SULPHUR.

Sulphur is recommended for the control of powdery mildew of apple trees, of mildews generally, and rusts.

Repeated trials have shown that the only satisfactory sulphur to employ as an orchard spray is colloidal sulphur. This, when used alone, is recommended at from 2 to 4 lb. per 100 gallons of water; and, when combined with lime-sulphur, at 2 lb. per 100 gallons. Commencing at petal-fall, this spray should be applied throughout the season at the periods indicated in the spraying schedules for pome and stone fruits on pages 215 and 216.

LIME-SULPHUR.

This is a dual-purpose spray, since it may be used either as a fungicide or as an insecticide. At the recommended concentrations it may be used as a winter, spring, or summer spray.

A winter application may be applied to deciduous trees at a concentration of 0·5 per cent.; but this is not recommended, as better results are to be secured by a bordeaux mixture application for the control of fungous diseases, or a winter oil for insect pests. As a spring application, apply a 0·2-per-cent. concentration at open-cluster for the control of black-spot, powdery mildew, and also diseases of stone fruits. A table of dilutions appears on page 210.

For summer use on both pome and stone fruits apply several sprays at a concentration of 0·1 per cent. and 0·083 per cent. (the weaker concentrations for stone fruits and less tolerant apple varieties), applications to be made at a ten-day interval following the petal-fall application, and afterwards at fourteen to twenty-one day intervals.

Table of Lime-sulphur Dilutions.

Polysulphide Content of the Concentrate in Percentages W/W.*	Volume of Concentrated Lime-sulphur required to prepare 100 Gallons of Spray containing a Polysulphide Content of											
	1 per Cent.		0·5 per Cent.		0·2 per Cent.		0·1 per Cent.			0·083 per Cent.	
	Gal.	pt.	Gal.	pt.	Gal.	pt.	Gal.	pt.	oz.	Pt.	oz.
8	12	4†	6	2	2	4	1	2	0	8	6
9	11	1	5	4½	2	1¾	1	0	18	7	8
10	10	0	5	0	2	0	1	0	0	6	13
11	9	0	4	4	1	6½	0	7	4	6	0
12	8	2½	4	1	1	5¼	0	6	13	5	10
13	7	5½	3	6¾	1	4¼	0	6	3	5	2
14	7	1	3	4½	1	3½	0	5	14	4	15
15	6	5	3	2½	1	2½	0	5	7	4	9
16	6	2	3	1	1	2	0	5	0	4	3
17	5	7	2	7½	1	1½	0	4	14	3	18
18	5	4	2	6	1	1	0	4	9	3	14
19	5	2	2	5	1	0½	0	4	4	3	10
20	5	0	2	4	1	0	0	4	0	3	5

* Taken to the nearest whole number. Thus 10·35 = 10 per cent., 10·60 = 11 per cent. This table is applicable only when the polysulphide content has been given in percentages by weight.

† Given in Imperial gallons, pints, and fluid ounces.

To prepare 100 gallons of spray, half fill the spray tank with water, add the required volume of concentrated lime-sulphur, then fill the tank to the 100 gallon mark. To prepare a small quantity of spray, as 4 gallons (the capacity of a benzine tin), multiply the number of *pints* by 20 and divide by 25. This will give, in *fluid ounces*, the required quantity of concentrated lime-sulphur.

The summer applications will hold in check black-spot and other major diseases of pome fruits (when mildew is prevalent the addition of colloidal sulphur is recommended), and brown-rot and leaf-rust of stone-fruits.

The concentration of a lime-sulphur should be measured by its polysulphide content.

Lime-sulphur is recommended as a general fungicide for applications to plants during the growing season, a safe concentration for most purposes being 0·1 per cent.

As an insecticide lime-sulphur will hold in check scales, red mite, pear leaf blister-mite, &c.

Bordeaux Mixture.

Two formulæ are recommended: Winter strength, 5–4–50; summer strength, 3–4–50.

As a foundation spray for the control of fungous diseases of pome and stone fruits, bordeaux 5–4–50 is recommended in preference to

lime-sulphur at 0·5 per cent. concentration. Application should be made at tight-cluster on pome fruits and at bud-movement on stone fruits.

For the control of leaf-curl of stone fruits two applications of bordeaux 3–4–50 are recommended, (1) when the buds begin to swell, and (2) about ten days later.

For fungous diseases of pears, citrus, tomatoes, potatoes, and most vegetables bordeaux 3–4–50 may be used during the summer months.

Bordeaux mixture should be prepared in the following manner: Fill the spray tank three parts full with water; dissolve the required quantity of copper sulphate in water (3 or 5 lb. for each 50 gallons of water), add to the tank, and start the agitator running. The copper sulphate may be dissolved with rapidity if hot water is used (5 lb. will go into solution in a minute or so in 1 gallon of boiling water), or, if first powdered may be added directly to the spray tank. Alternatively, it may be placed upon the strainer covering the intake, so that the incoming stream of water carries the particles into the tank, in which case it will go into solution within two minutes. When the dissolved copper sulphate has been added, weigh out the required quantity of commercial hydrated lime (4 lb. for each 50 gallons of water), mix to a thin paste with cold water, and with the agitator still running pour slowly into the tank, at the same time filling the tank to its capacity. Keep the agitator running for a further few minutes, and the spray is then ready for application.

The hydrated lime must be of good quality, containing not less than 90 per cent. of $Ca(OH)_2$; if the content is less than this, adjustment must be made accordingly.

BURGUNDY MIXTURE.

Burgundy is a somewhat inferior substitute for bordeaux. In burgundy 5 lb. of washing soda is used in place of each 4 lb. hydrated lime in bordeaux. Burgundy may be used on tomatoes or potatoes, provided the spray is not mixed with nor applied with arsenate of lead. Comparable concentrations with bordeaux may be used and at similar times of application.

ARSENATE OF LEAD.

This spray is recommended for the control of chewing insects such as codling-moth, leaf-roller caterpillar, bronze beetle, pear-slug, &c. A dosage of 1½ lb. (powder) or 3 lb. (paste) to 100 gallons of water is recommended.

For codling-moth the first spray should be applied at petal-fall, and subsequently at three-weekly intervals until the end of January.

For the control of leaf-roller caterpillar the codling-moth control sprays should be continued later into the season on late varieties of apples. Applications are often discontinued too soon to obtain satisfactory control of the caterpillar.

Bronze beetle may be controlled by this spray, provided the fruit is kept well covered with arsenate while the beetle is active. Cultivation up to the orchard boundary, completed by the beginning of November, will materially assist in the control of this pest.

NICOTINE.

Nicotine at a concentration of 95 per cent. and nicotine-sulphate (nicotine content 40 per cent.) have been used for a number of years in New Zealand in combating soft-bodied insect pests. When used alone these sprays are more costly than and inferior to summer oils

STAGES OF APPLE-BLOSSOM DEVELOPMENT.

(1) Green-tip; (2) tight-cluster; (3) open-cluster; (4) pink; (5) full-bloom; (6) petal-fall; (7) calyx-closed.

[*Drawing by N. J. Adamson.*

for outside use. In confined spaces, however, such as glasshouses nicotine has proved an effective controllant of white fly, green aphis, &c. Nicotine or nicotine sulphate is applied outdoors at a concentration of 0·05 per cent., and under glass at a concentration of 0·04 per cent. To

prepare a nicotine spray in accordance with this recommendation (i) to obtain a 0·05-per-cent. concentration use nicotine at 1–1900 ($\frac{2}{5}$ pint approximately to 100 gallons), or nicotine sulphate 1–800 (1 pint to 100 gallons); and (ii) for a 0·04-per-cent. concentration use nicotine at 1–2400 ($\frac{1}{3}$ pint to 100 gallons), or nicotine sulphate 1–1000 ($\frac{4}{5}$ pint to 100 gallons). When used alone add soap at rate of 4 lb. to each 100 gallons of spray. Do not use soap when nicotine sprays are combined with lime-sulphur, lead arsenate, or bordeaux.

OILS.

Oil sprays differ in constitution, according to whether they are prepared for winter or for summer use; consequently it is necessary to recognize two types—winter oils and summer oils. If winter oils are applied during the growing season serious injury may follow, even when they are used at such low concentrations as 0·5 per cent. The oils for winter and summer use should therefore be of the type recommended and be applied at the following concentrations:—

Winter Oils.—Recommended for the control of woolly aphis and scale insects of pome and stone fruits. Apply during the dormant period to stone fruits, and not later than bud movement to pome fruits.

For woolly aphis, lecanium scale, and mussel scale of apples and pears, apply at 3 per cent. concentration (see table of dilutions on page 214). For San Jose scale of both pome and stone fruits apply a 5-per-cent. concentration.

Summer Oils.—For red mite two applications of a summer oil at a concentration of 1 per cent. to 2 per cent. are recommended; the first application to be made at mid-February, the second about ten days later. At least fourteen days should be allowed to elapse before applying an oil spray following a sulphur or lime-sulphur spray. If the foliage is in poor condition the period should be extended to four weeks.

For black and green aphis and cherry slug of stone fruits apply a 1-per-cent. concentration when the pests become noticeable.

A 1·5-per-cent. concentration is recommended against apple leaf-hopper, application to be made after mid-January when the nymphs appear.

For red and black scales of citrus two applications of 2½ per cent. summer oil at an interval of fourteen to twenty-one days during the early summer or autumn, is recommended.

METHOD OF PREPARING OIL SPRAY.

Stir the oil in the drum. Then pour out the required quantity into a clean mixing vessel. Add slowly water* equal to the volume of oil. Stir thoroughly (or, better still, pump the mixture vigorously through a hand pump for several minutes), when an emulsion free from lumps and free oil should result. The spray tank and pump should be thoroughly washed out to remove the residue of previous sprays, such

* If the water is hard add washing soda at the rate of 1 lb. to 100 gallons water. If this quantity is not sufficient add just sufficient additional washing soda to bring about a complete emulsion.

as lime-sulphur and bordeaux. While the required quantity of water is being run into the tank, with the agitator running, add slowly the prepared emulsion. A spray in which free oil is present should not be used until the free oil has been emulsified. This can usually be readily done if free oil appears by the addition of about 1 lb. of washing soda to each 100 gallons water if the above directions have been observed.

Table of Oil Dilutions.

(To prepare 100 gallons of spray of the required concentration, add the quantity of oil given in the upper figure to the volume of water specified in the lower figure.)

Oil Content in Bulk Supply, in Percentages.	Percentage of Oil Concentration required.					
	10.	5.	4.	3.	2.	1.
100	10·0 90·0	5·0 95·0	4·0 96·0	3·0 97·0	2·0 98·0	1·0 99·0
95	10·5 89·5	5·3 94·7	4·2 95·8	3·1 96·9	2·1 97·9	1·05 98·95
90	11·1 88·9	5·5 94·5	4·4 95·6	3·3 96·7	2·2 97·8	1·11 98·89
85	11·7 88·3	5·8 94·2	4·7 95·3	3·5 96·5	2·3 97·7	1·17 98·83
80	12·5 87·5	6·25 93·7	5·0 95·0	3·75 96·25	2·5 97·5	1·25 98·75
75	13·3 86·7	6·7 93·3	5·3 94·7	4·0 96·0	2·7 97·3	1·33 98·67
70	14·3 85·7	7·1 92·9	5·6 94·4	4·3 95·7	2·8 97·2	1·42 98·58
65	15·4 84·6	7·7 92·3	6·1 93·9	4·6 95·4	3·1 96·9	1·53 98·47
60	16·7 83·3	8·3 91·7	6·7 93·3	5·0 95·0	3·3 96·7	1·66 98·34
55	18·2 81·8	9·1 90·9	7·3 92·7	5·4 94·6	3·6 96·4	1·81 98·19
50	20·0 80·0	10·0 90·0	8·0 92·0	6·0 94·0	4·0 96·0	2·0 98·0
Empirical formula*	1–10	1–20	1–25	1–33	1–50	1–100

* Based on the assumption that all oils are of 100 per cent. concentration.

These figures are taken to the nearest fraction. In using the table the orchardist has but to ascertain the quantity of spray his tank holds and to add the required proportion of water, then the oil in the form of a cream-like emulsion. It is sufficient to take the oil to the nearest quarter gallon (save in the greatest dilutions) and the water to the nearest whole gallon.

COMBINATION SPRAYS.

In order to reduce the number of applications certain combination sprays may be employed with advantage, provided the following precautions are observed :—

Lime-sulphur and Lead Arsenate.—Fill the tank with water and to this add the required volume of lime-sulphur. To the required quantity of lead arsenate add three times its weight of hydrated lime, mix with water to form a thin paste, and pour it into the spray tank while the agitator is running. Apply as rapidly as possible after mixing.

Lime-sulphur plus Colloidal Sulphur.—To a 0·1-per-cent. concentrate of lime-sulphur add 2 lb. of colloidal sulphur. This combination is safer to apply and more effective than either spray used alone, and is recommended for the control of powdery mildew and black-spot of apples, brown-rot and leaf-rust of stone fruits, &c.

Summer Oil plus Nicotine.—One application of this combination, in which nicotine 95 per cent. at concentration of 0·04 per cent. (1–2500) or nicotine sulphate 40 per cent. at the same concentration (1–1000), is added to a summer oil at 1-per-cent. concentration, is almost as effective as, though more expensive than, two summer oil sprays, and considerably more effective than nicotine used alone.

Spray Schedule for Pome Fruits.

Period of Application.	Treatment.	Disease or Pest.
(1) Bud-movement	Winter oil 3 per cent. to 5 per cent.	Scales and woolly aphis (5 per cent. for San Jose scale).
(2) Green-tip	Bordeaux mixture 5-4-50, or lime-sulphur 0·5 per cent.	Black-spot.
(3) Tight-cluster* ..	Lime-sulphur 0·2 per cent.	Black-spot, powdery mildew.
(4) Pink	Lime-sulphur 0·1 per cent.	Black-spot, powdery mildew.
(5) Petal-fall	Lime-sulphur 0·1 per cent., plus colloidal-sulphur 2 lb., and lead arsenate (1½ lb in 100 gallons spray)	Black-spot, powdery mildew, codling-moth, bronze beetle.
(6) Ten days later ..	Repeat petal-fall spray	
(7) Fourteen to eighteen days' intervals up to mid-December	Repeat petal-fall spray	
(8) Subsequently at fourteen- to twenty-one-day intervals till mid-January, and later as required	Lime-sulphur 0·083 per cent., plus colloidal-sulphur 2 lb., and lead arsenate (1½ lb. in 100 gallons spray)	Black-spot, powdery mildew, codling-moth, leaf-roller caterpillar.
(9) Between mid-January and beginning March†	Summer oil 1 per cent. to 2 per cent. Two applications at ten-day intervals†	Red-mite, scales, woolly aphis.

* On pears bordeaux 3-4-50 is recommended from this period onwards.
† Do not apply until fourteen days have elapsed preceding or following sulphur or lime-sulphur sprays.

Apple leaf-hopper may be combated by a 1·5-per-cent. summer oil application when nymphs appear after mid-January; or, alternatively, a nicotine sulphate spray (1–800) may be applied.

Spray Schedule for Stone Fruits.

Period of Application.	Treatment.	Disease or Pest.
(1) Dormant	Winter oil 3 per cent to 5 per cent	Scales (5 per cent. for San Jose scale).
(2) Bud-movement of blossom buds	Bordeaux mixture 5–4–50	Leaf-curl, shot-hole, bladder-plum.
(3) Early pink* ..	Bordeaux mixture 3-4-50, or lime-sulphur 0·2 per cent.*	Leaf-curl, brown-rot,* shot-hole.
(4) Petal-fall	Lime-sulphur 0·083 per cent., plus colloidal-sulphur (2 lb. to 100 gallons spray)	
(5) One month after petal-fall	Repeat No. 4	Brown-rot, shot-hole, leaf-rust
(6) Seven weeks after petal-fall	Repeat No. 4	
(7) Five weeks prior to anticipated first picking	Repeat No. 4	
(8) Three to two weeks later	Repeat No. 4	

* If season favourable to brown-rot development, apply an additional spray of 0·1-per-cent. lime-sulphur when majority of buds are at the pink stage.

When black and green aphis are prevalent, apply a 1-per-cent. summer oil, and follow with a second if after four to five days viable insects are noticeable.

For leaf-roller caterpillar on plums and cherries apply 1 lb. lead arsenate, plus 3 lb. hydrated lime per 100 gallons. On peaches, nectarines, and apricots use one or two 1-per-cent summer oil sprays, as these plants will not tolerate arsenates.

Spreaders.

Reference to the use of spreaders has been omitted, since their usefulness when combined with lime-sulphur and sulphur sprays is doubtful, and also on account of arsenates frequently having spreaders incorporated in them.

Treatment of Tree Wounds and their Sterilization.

It is very necessary that tree wounds should receive proper attention to prevent bacteria or the spores of fungi gaining entrance through the exposed tissues. Remove diseased or damaged tissues and sterilize the wounds. The work should be done thoroughly, for if infected tissue remains the disease may again become active.

Acidulated mercuric chloride on the basis of the following formula is recommended for sterilizing: Mercuric chloride, 1 gramme ($\frac{1}{28}$ oz. avoirdupois approximately); hydrochloric acid, concentrated, 15 c.c. ($\frac{1}{2}$ fluid oz. approximately); water, 1,000 c.c. (36 fluid oz. approximately).

To prepare the solution dissolve the mercuric chloride in the acid, then add the mixture carefully to the water. Mix thoroughly before use. Metals should not be allowed to come into contact with the solution. Mix in porcelain or enamelware container, and store in a glass-stoppered bottle. The mixture is poisonous, and should be labelled "Poison—not to be taken."

The mixture can be made up in stock solution by adding 20 grammes ($\frac{5}{7}$ oz. avoirdupois approximately) of mercuric chloride to 300 c.c. (11 fluid

oz. approximately) of commercial concentrated hydrochloric acid. To use, dilute one part of this stock solution with 60 parts of water. Keep in a glass container and label as poison.

When the wound is dry, protect with coal tar or thick white lead paint.

Bordeaux Paste.—Made according to the following formula, this is often recommended for treatment of wounds on citrus caused by the bark-blotch organism and collar-rot: Copper sulphate, 1 lb.; hydrated lime, 2 lb.; water, 1·5 gallons.

To prepare, dissolve the copper sulphate in half the quantity of water, and add the remainder to the lime. Stir the lime mixture into a stiff paste, at the same time slowly adding the copper sulphate solution. When mixed it has the consistency of treacle. Apply with a stiff brush.

THE PIG INDUSTRY AND FEED-SUPPLIES.

HOW FAR THE PRACTICE OF DENMARK APPLIES TO NEW ZEALAND.

M. J. SCOTT, Canterbury Agricultural College, Lincoln

IN most discussions about the pig industry comparisons are made between Denmark and New Zealand, and generally it is concluded that New Zealand can develop pigs on the same extensive and profitable lines as Denmark has done. The common view is summed up in the following sentence: "New Zealand cannot produce grain at world prices, and as Denmark is similarly placed, she has to import the grain she requires for stock foods, which could be done by New Zealand just as cheaply."

A review of Denmark's production figures and market returns creates some doubt as to the accuracy of the statement.

PRODUCTION OF FEED.

Relative to production of feed, from page 171 of the handbook "Denmark," 1931, the information contained in Table 1 is extracted.

Table 1.—Areas in Different Crops in Denmark in the Years indicated.

Crop.	1881.	1896.	1912.	1928.	Percentage of Area devoted to each Crop in 1928.
Grains	1,251*	1,316	1,286	1,380	47
Roots and potatoes ..	71	157	389	550	18½
Grass and green fodder ..	1,069	1,090	946	906	31
Other crops (seed) ..	74	38	33	34	1
Fallow	295	309	228	76	2½
Total areas ..	2,758	2,910	2,892	2,945	..

* Areas given in thousands of hectares. One hectare equals 2½ acres approximately.

From a study of this table it is evident that Denmark is largely a grain-producing country, but she has made only a slight increase in the area devoted to grain during the last fifty years. Forty-six per cent. of arable area is under grain crops.

Prior to 1880 (page 170*) the value of Denmark's grain exports totalled about 60 per cent. of the whole agricultural export, but the low grain prices in the "eighties" and "nineties" compelled the Danish farmers to change from grain-production to animal husbandry (page 71).

Owing to better cultivation, to the use of fertilizers, and to better strains of crops, yields have been greatly increased. These are set out in the following table (page 172).

All crops are included for reference later.

Table 2.—Yields of Stock Feeds, in Millions of Quintals of Feed Units.
(1 quintal of feed units = 100 kilos or 220 lb. of barley.)

Kind of Feed.	1880–84.	1895–99.	1910–14.	1928–29.
Grain	18·4	19·8	22·5	35·1
Straw	5·2	5·6	6·6	11·3
Roots	1·8	5·9	18·6	29·4
Hay	4·0	6·3	6·9	5·6
Grass and green fodder	11·1	12·4	15·0	23·0
Imported grain	0·2	5·6	7·7	12·1
Skim milk	1·9	2·8	5·0	7·0
Total	42·6	58·4	82·3	123·5

From this and the preceding table it will be seen that since 1880, when Denmark found she could not sell grain as such on the world's market, she has doubled her production of grain and trebled her production of feed without any appreciable increase in total area under cultivation. These two tables should dispel the idea that Denmark is not a grain-producing country. They should also make it clear that she produces, along with grain, an abundance of other feed.

Utilization of Feed produced.

Consideration of how this feed-supply is used should help to prevent the drawing of further erroneous conclusions about Denmark. The following table sets out the amounts of feed required for different purposes. These are taken partly from the handbook "Denmark, 1931," otherwise they are calculated on internationally accepted standards.

Table 3.—Feed required for Different Purposes

Stock (Thousands)	Feed Units, Millions of Quintals per Year.
Dairy cows, 1,579, maintenance at 4 feed units per day	23·0
Produce, 5,050 million kilos milk at 0·4 feed unit per kilo	20·2
Other cattle, 1,452 at 4 feed units per day	21·0
5,350 pigs, killed (190 lb. live weight), 2 feed units to produce 100 lb live weight (fed from 26 lb. to 190 lb) plus 30 per cent. for breeding stock	22·8
Bedding as straw	3·0
520 horses at 9 feed units per day	17·0
200 sheep at 11 feed units per week	0·8
23,000 poultry at 35 feed units per year	8·2
For seed and human consumption	8·0
Grand total	124·0

* The pages to which reference is made herein are of the handbook "Denmark," 1931.

Feed provided in Table 2 is thus accounted for in Table 3.

In "Denmark," 1931 (page 176), the amount of feed for pigs and poultry is given at 37,000,000 quintals, but details are not given as for cows and milk-production. In Table 3 the calculated amount for pigs is 34,000,000 quintals, and of this 3,000,000 quintals is in the form of straw for bedding. Thirty-four million quintals accords better with total feed-production than 37,000,000 quintals does.

PIGS AND POULTRY.

Amount of Home-grown and Imported Feeds and the Returns per Ton from them.

The 34,000,000 quintals of feed could be provided reasonably from the following sources:—

Table 4.

		Million Quintals.
Bedding (straw)	..	3·0
Milk, 7,000,000 quintals (two-thirds for pigs and poultry)	..	4·6
Home-grown—		
Rye .. 2,600,000; Barley .. 11,100,000	Total grown, less 1,000,000 for seed	12·7
Wheat offals ..	..	0·8
Roots or meslin	..	4·1
Imported—		
Wheat offals .. 700,000; Rye .. 2,200,000; Maize .. 5,900,000	Total imports	8·8
Total	..	34·0

In this total, 8,800,000 quintals of feed, out of 31,000,000 eaten, are imported grain. This is the fact that is seized on by those who make the statement that Denmark's pig industry depends on imported grain. That the grain is used for pigs and poultry is admitted, but this in no way proves that the pig industry has developed because of imported grain. It may be that the poultry industry has developed. The reverse, that imported grain has come in because these industries were profitable, is more probably the case Any animal project is profitable when feed costs are a small proportion of the returns, and that condition obtains when grass or roots are largely used as with sheep and dairy cows in New Zealand. Grass or roots cost per feed unit from one-eighth to one-sixth of what grain does Table 4 shows that roots may constitute 20 per cent. of pig-feed used in Denmark. (This amount could well be used for sow maintenance.) There is a certainty that the use of roots has been a factor of considerable importance in the development of the Danish pig industry.

A matter of importance in the use of grain is the value of produce sold.

Denmark exports £20,000,000 sterling worth of bacon, and this on the basis of 5,350,000 carcasses (pages 71, 72) each of 140 lb. dead weight is equivalent to a price of 6·4d. per pound. Denmark exports cured bacon, however, and if the usual allowance of 30 per cent. of offals in bacon-curing is made, the price of cured bacon is about 9d. per pound.

Feed used is about 23,000,000 quintals, consequently the gross return to Denmark is about £9 per ton of feed units: net return—*i.e.*, price feeder could pay landed on the farm—would be approximately

75 per cent. of this—*i.e.*, £6 15s. The question arises whether New Zealand could do this. If we exported the same number of pig carcasses as Denmark does and received 6·4d. per pound in London, the total value would be £20,000,000 sterling. But export charges at 2½d. per pound amount to £7,800,000 sterling, so that the return to New Zealand farmers would be £12,200,000 sterling.

This would be about £6 gross per ton for feed unit used. Corresponding net return or price payable by the feeder would be £4 10s. If we exported Denmark's quantities and got 4½d. per pound in London the total value would be £14,000,000 sterling. Export charges would be still £7,800,000 sterling, and the return to New Zealand farmers would be £6,200,000 sterling, or about £3 gross per ton of feed units. This is equivalent to about 10s. per ton of mangels (6 ton mangels=1 ton feed units), 1s. 6d. per bushel of wheat, 1s. 4d. per bushel of barley, and so on.

New Zealand can produce crops of grass and roots at less than £3 per ton of feed units, but she can neither produce nor import grain at this price. When we have copied Denmark by growing abundance of cheap fodder, the pig industry will develop, and, because of profits made on these home-grown bulk feeds, we will be able to use grains either bought or home-grown. It will then be possible to use grain at higher prices than are now paid for it.

Increasing Export Value by Manufacturing in New Zealand.

In the case of pigs it has been shown that when London prices are 4½d. per pound and export charges are 2½d. per pound the New Zealand value of Denmark's produce is £14,000,000 sterling, of which £7,800,000 sterling is spent in putting it on the London market, and £6,200,000 sterling is returned to farmers. It would benefit New Zealand to retain more of the £14,000,000 sterling, and this could be done by in some way processing the carcasses so as to increase the value per pound of the weight exported, thus reducing the proportion of their value absorbed by freight to £5,500,000.

Even though the foregoing information had countered the suggestions, (1) that Denmark is not a grain-growing country, (2) that her pig industry has been built up on imported grain, and (3) that if Denmark is able to import grain New Zealand can do the same, there still remains an impression at the back of most people's minds that grain is essential to the pig industry. This is firmly established because of the undisputed improvement in the dietetic value of milk when grain is used with it and because of the improvement in carcass quality where grain is used. There is a possibility that the use of a small quantity of grain with milk might be worth while. The possibilities of using different proportions of grain at different prices are explored in the following paragraphs.

The importance of pigs in New Zealand is bound up with the dairy industry, and the cash returns per cow must be the yardstick by which the condition of the industry is measured. Too often comparisons are made between Denmark, where returns as high as £20 per cow (9·6d. per gallon for 500 gallons) are obtained, and ourselves where returns from £2 up to £5 per cow are obtained (0·96d. to

2·4d. per gallon for 500 gallons). These low returns on our part are not the result of inefficiency on the part of the farmer, nor of inability on his part to compound rations capable of high production. Low returns are entirely a question of costs of feed used and selling-price of pork, and if our prices for these two commodities were the same as those ruling in Denmark, then we would be able to get as good returns as the Danes. Some will say that our returns for pork are only about 2d. per pound below the return obtained by the Danes, and, such being the case, that our returns per cow should be two-thirds or five-sevenths that of the returns obtained in Denmark, when our prices are 2d. less than theirs.

Unfortunately this is not so, and an increase in price of 2d. per pound of pork increases the return per gallon of milk in an extraordinary way, depending on the proportion of grain and skim milk that are fed. (See Table 5.)

There is a very well-defined and sensitive balance—*i.e.*, suddenly changing– between pork prices, grain prices, and returns per gallon of milk. The less grain used the less sensitive the change, and the less is the maximum return obtainable for milk when grain is cheap and pork is dear.

Table 5 sets out the gross returns obtained per gallon of milk with different classes of feeding at different prices of pork and different costs of feed.

The process of arriving at these returns per gallon is as follows :–

(*a*) Definite quantities of milk or milk and grain are required to produce a fixed quantity of live weight (100 lb equal to 70 lb. of pork).

(*b*) One hundred pounds of live weight (equal 70 lb. of pork) returns 280d. at 4d. per pound, 350d. at 5d per pound, and so on.

(*c*) The cost of grain used is deducted from this amount, and whatever is left is credited to the milk. This amount divided by the gallons of milk used gives the gross return per gallon.

If it is desired to make the comparison on the basis of net returns, that is, deducting labour, overhead, cartage, commission, &c., a deduction of about 1½d. per pound of carcass should be made. This will reduce the returns per gallon of milk in paragraph (*a*) by 0·28d. per gallon, in paragraph (*b*) by 0·36d. per gallon, in paragraph (*c*) by 0·66d. per gallon, and in paragraph (*d*) by 2·10d. per gallon. It is debatable whether the gross or net returns should be used, since the lower net returns are offset by the fact that the feeder had received wages which, without pigs, he would not receive.

Where the figures are in heavy type the gross return from skim-milk are less than those from milk used alone–*i.e.*, the use of grain is unprofitable at those prices for grain and pork.

Para. (*b*) of the table shows that where a little grain is used with skim-milk the returns for milk are little different from those where milk is used alone. When there is a loss it is so small that it is not noticeable, and consequently farmers have used grain with milk in this way even when grain was £12 per ton.

Para. (*c*) shows that grain used in this way gives wider variations in the returns for skim-milk and sufficient losses at low pork prices and high grain prices to prohibit the use of grain in these proportions by New Zealand farmers.

Table 5.—Showing Returns per Gallon of Milk in Pence, with Specified Variations in Price of Grain and Pork.

Paragraph.	Ration used to produce 100 lb. Increase in Live Weight.	Price of Grain per Short Ton.	Price of Pork per Pound, in Pence.						
			4d.	5d.	6d.	7d.	8d.	9d.	12d.
(*a*)	Milk alone (380 gallons)	..	0·74	0·92	1·11	1·29	1·48	1·66	2·22
		£							
(*b*)	80 lb. meal, 290 gal. milk.	6	0·77	1·01	1·25	1·49	1·73	1·97	2·69
		9	**0·67**	**0·91**	1·15	1·39	1·63	1·87	2·59
		12	**0·57**	**0·81**	**1·05**	**1·29**	1·53	1·77	2·49
		£							
(*c*)	200 lb. meal, 160 gal. milk.	6	0·85	1·28	1·72	2·15	2·59	3·02	4·32
		9	**0·40**	**0·83**	1·27	1·70	2·14	2·55	3·87
		12	**−0·05***	**0·38**	**0·82**	**1·25**	1·69	2·10	3·42
		£							
(*d*)	300 lb. meal, 50 gal. milk.	6	1·28	2·68	4·08	5·48	6·88	8·28	12·18
		9	**−0·88***	**0·52**	1·92	3·32	4·72	6·12	10·32
		12	**−3·04***	**−1·64***	**−0·24***	**1·16**	2·56	3·96	8·16

Returns per gallon of milk, in pence.

* An actual loss of this amount per gallon.

Para. (*d*) shows that grain used in this way gives still wider variations in the returns for skim-milk. When pork prices are high the returns from skim-milk are very profitable, but if pork prices are low and grain prices are high the loss on milk is great. This is apparently the way grain is used in Denmark, where about one-fifth of the pig-feed supply is milk. In order to consume the same milk-supply with much grain, as here, approximately eight times as many pigs have to be used as when no grain is used. If grain were procurable at £6 per ton the New Zealand pig-farmer would treble his return per gallon of milk when pork is 5d. per pound—*i.e.*, he would be getting the returns from three pigs and paying out the returns for the other five to the grain-producers. Few farmers would undertake such a philanthropic project.

Those who seek to develop the pig industry may have in mind less ambitious schemes than increasing the pig numbers by eight times. A perusal of Bulletin No. 17 of the Department of Scientific and Industrial Research, containing a statement by F. R. Callaghan, on supply of pig feed in the Dominion will show that there is available sufficient feed to produce four and a half times as many pigs as we now produce. This should set their minds at rest as to the necessity of imported grain in the development of the industry.

Possible Lines of Development of the Pig Industry.

Mr. A. H. Cockayne has repeatedly pointed out that the dairy industry has developed chiefly because of (1) home separation, (2) top-dressing, (3) better strains of grass, (4) winter-feed conservation, (5) rotational grazing, and (6) herd-testing. All these practices have

such obvious advantages that dairy-farmers could not afford to ignore them, consequently they have been widely adopted, with the result that the industry has prospered. The pig industry will develop similarly when the pig-farmer has placed at his disposal advantages that he cannot afford to ignore. The introduction of imported grain cannot be such an advantage.

Feeding-trials and pig-recording have shown that there are a number of practices that can be adopted with advantage. These are as follows :—

(1) The use of some nitrogenous food supply (meat meal) with present winter feeds so as to carry store pigs through the winter in a fit condition. When this is done two litters per sow can be reared each year, thus increasing our output of pigs by 40 per cent. The use of meat meal with winter feeds when no milk is available for store and breeding stock almost trebles the feeding-value of roots and other winter feeds. (See results of feeding-trials conducted by Lincoln College and the Department of Agriculture.) Used along with milk, meat meal gives a better return for milk than grain does. (See Waikato pig-recording results.) Used along with whey for fattening pigs meat meal improves the return for whey by about 50 per cent. (See feeding-trials 1927–28, Lincoln College.)

(2) The adequate feeding of the sow prior to farrowing : During the last five years pig-recording in the Waikato district has effected an improvement of 30 per cent. in sow-production. Cheap weaners are vital to the industry. Better litters mean reduced overhead costs.

(3) The use of grass and roots (cheap feed) along with milk and grain : An improvement of over 20 per cent. in the returns obtained from milk used can be made when one-quarter of the pig feed is supplied in the form of grass or roots. The profitable use of grain as a pig feed can be developed only when a considerable amount of roots is used along with grain. From feeding-trial results it is calculated that the return per acre from barley alone (40 bushels per acre) is about £4 when pork is 4d. per pound. If three-quarters of the grain area were sown in grain and the other one - quarter used to grow roots (40 tons to the acre) for pig feed the return per acre would be increased to £7 10s. per acre for the whole area. The cost of growing roots is probably twice as great per acre, but the improved return by growing roots and grain on present grain areas and converting them into stock products warrants a consideration of the possibilities of pigs, especially since the returns from grain are so unsatisfactory.

(4) There is a possibility that the production of cured bacon for export may also be a factor in improving returns from pigs. If New Zealand were to export as many pigs as Denmark does, the total charges between the farm and the market would amount to just on £7,000,000 (5,350,000 carcasses of 140 lb. at 2¼d.) If these carcasses were turned into bacon the export value would be as great as that of green carcasses, but the export charges would be about 30 per cent. less.

PINK-EYE IN SHEEP.

C. S M HOPKIRK, Veterinary Laboratory, Department of Agriculture, Wallaceville, Wellington

THE name " pink-eye " is given to an acute inflammation of the eyes of sheep and is referred to as contagious ophthalmia or contagious irido-cyclitis.

The disease makes its appearance in the hot dry weather, usually when green feed is becoming scarce. It was at one time looked upon as being due to injury to the eyes from grass-stalks or as a reaction to the pollen of certain grasses, much as asthma occurs in human beings. Both these reasons have been shown to be wrong. In South Africa a minute body invading cells and known as a " Richsettia body " is said to be responsible, but, as yet, this organism has not been found in affected sheep in New Zealand.

A considerable amount of experimental work has not thrown any very intense light on the disease. At Wallaceville, where the flock has on two occasions been visited in the last few years with pink-eye, the occasions have been in exceptionally dry seasons after pollination is over and after the grass has been topped, either for hay or by mower. The sheep are noticed to be partially blind, in that they circle round, run into fences and even run into the drover in severe cases. Usually the sheep can just distinguish an obstacle and will avoid it, but is unable to see wire fences and will run into them with considerable force. When the sheep is caught the eye is noticed to be very damp, the tears having run down the face, the cornea—outer covering of the eye—is opaque and may, where injury has occurred through running into fences, &c., have become ulcerated or show a degree of necrosis. Beneath the cornea and round the iris is seen a circle of pink, which is due to congested blood-vessels in that area, and which gives the reason for the very descriptive name of " pink-eye " to the disease.

The sheep is sensitive to light, and unless driven will keep its eyelids partly closed. If driven its head goes up in the air and the eyeballs stare sightlessly, while the sheep endeavours to follow the flock by sound. One eye is usually affected first, to be followed quickly by the second. Occasionally both become infected together. Inflammation persists for two or three weeks in severe cases.

Considerable efforts have been made to find the organism responsible for this disease. That the condition is very contagious is seen by the fact that a drop of a dilution of 1-100 of tears from an infected sheep will set up inflammation in an eye of a normal sheep in from two to three days, while the second eye becomes inflamed two days later. It is some seven days from the time of infection that the disease reaches its height. If the tears are filtered they do not cause inflammation, showing that the disease is unlikely to be due to a virus or to a chemical change of the tears themselves. Many organisms which have been grown from affected eyes do not appear harmful when introduced into normal sheep. Tears given by drenching or placed intravenously into the sheep have no effect in the few cases tried, but diluted tears poured up the nostril set up inflammation in the eye of that side.

Sheep apparently become infected from other sheep either by fly carriage or from drinking-troughs. Flies have not been seen to worry sheep at Wallaceville, except possibly a small sand-fly which gets into the corners of eyes. It is known, however, that on the last outbreak of pink-eye the neighbouring farm had the trouble before the sheep in the laboratory flock, and a watering-trough connects the two lots of sheep. The inference, therefore, is that the laboratory flock became infected from the trough.

Droving along dusty roads appears to be a method of infection, the organism being present in the dust of stock routes in certain districts, for many flocks of a certain North Island district become infected if taken out on the highway in the late summer. There is reason to believe that sheep gain a certain amount of immunity to the disease, for older sheep previously affected or flocks in which the disease frequently appears do not seem to suffer as greatly as a flock invaded for the first time. In this latter case the disease is found to affect all the sheep.

TREATMENT.

For the treatment of pink-eye old shepherds use a barbarous method, that of putting powdered glass or sugar in the eye, "to cut off the white" they explain. In these days one wonders at the survival of such crude treatment. There are several dressings which can be applied with advantage to the eye, the cheapest and most easily applied being—(*a*) boracic acid solution, 1 oz. to 2 pints of warm water; (*b*) zinc sulphate, 3 grains to 1 oz. of water; (*c*) argyrol, 1 part to 9 parts water; (*d*) yellow oxide of mercury, 1 in 50.

Any of these materials may be got from the chemist. The first three—(*a*), (*b*), (*c*)—should be applied to the affected eye in small quantities from a dropper, such as is used to fill fountain pens; the last one—(*d*)—can be obtained in pointed tubes from which the paste can be squeezed into the corner of the eye. Treatment may be carried out daily if suitable, or as often as possible while the eye is showing inflammation.

The act of running in the sheep for treatment, however, may far outweigh the beneficial effect of the eye lotions where the paddocks are rough, or the dogs not sufficiently under control. Blind sheep can be drafted into a small paddock where they can easily be caught for treatment. As a matter of prevention this should be done.

The inflammation passes off in about three weeks leaving the great majority of the sheep with usual eyesight. If, however, the sheep have been chased about and have had eyes injured in fences, &c., a percentage will be found blind.

Theoretically, it seems likely that there is a vitamin deficiency in the fodder of sheep in the dry season of the year which makes them susceptible to ophthalmia, so that any green feed given to an affected flock should be useful in preventing or helping to cut short an outbreak.

Cider-making.—The quantity of cider manufactured from the 1932 apple crop in New Zealand is estimated at 40,000 gallons, with a commercial value of some £10,000.

GRADING "GRAIN" IN HONEY.

W. D REID, Mycological Laboratory, Plant Research Station, and D. S. ROBINSON, Horticulture Division, Palmerston North.

RECENTLY honey samples have been examined to determine if crystal size indicates the "grain" of a honey. The samples have been derived from different sources, graded according to the tongue test, and then microscopically examined. At the present time grain is determined by the feel of the honey on the tongue, and points are allotted according to the fineness or coarseness so estimated. A smooth honey does not exhibit any perceptible grain, whereas a coarse honey is more or less sandy to the touch. Standards comparable to these extremes do not exist. It is evident that grain is dependent in some way on the component crystals, and examinations have been made to determine if size of crystal bears any relation to the present grading system.

Different honeys contain many types of crystals, and all types may be present in one honey. The common crystal forms are small plates, fine needle-like crystals, large compact plates, or large aggregates of either plates or needle-like crystals. In size all these types vary considerably, but in the majority of honeys the predominating crystals are small plates of 14 to 20 γ by 4 to 14 γ.*

In a microscopic examination of honey it is necessary to separate the component crystals, and for this purpose the best medium is a liquid honey either from freshly capped comb or from a liquefied honey, preferably of fine grain. A saturated sugar solution is also suitable, but rapid crystal formation interferes with examination of the slides

Two or three "pinhead" quantities of the honey to be examined are placed in a drop of the diluting honey, stirred with a sharp instrument, and covered with a cover slip. After a rapid survey of the slide the crystals can be measured by means of a scale eyepiece For examination a 16 mm. objective and a 10 × eyepiece have provided the most suitable magnification. In the following table of results these scale readings have been converted into their equivalent values in microns. In measuring the crystals both length and breadth have been recorded, but only the mean length has been included in the table. The ratio of length to breadth is not constant for all crystal forms, but in order to simplify subsequent comparisons only the greater measurement has been considered. In measuring the aggregate masses of crystals the same procedure has been adopted. The number of readings required for determining an accurate mean has not been calculated, but after many hundreds of examinations it appears that a minimum of 42 serves for the mean crystal size for a honey, or as few as 28 for the mean of the largest crystals present. A single slide provides 14 or more of the largest crystals. It is probable that accurate

* γ = micron—approximately $\frac{1}{25000}$ of one inch.

results would require many more readings per sample, but for practical purposes a minimum consistent with the accuracy of careful tongue grading is all that is required.

The results of the investigation are given in the following table:—

Results.

Number	Columns. 1.	2. Mean of All Crystals.	3. Mean of Largest Crystals.	4. Grading Points.	
	Per Cent.	γ.	γ.		
20	100	13·0	156	15	Group 1
21	75	25·6	254	13½	
22	65	35·0	330	13½	
23	50	37·4	350	13	
24	40	27·1	354	13	
25	30	22·7	635	12	
26	20	38·0	868	12½	
27	1	25·0	1380	10	
	Order of Grading.				
28	1	19·2	124	15	Group 2.
29	2	19·6	230	14	
30	3	16·8	156	14½	
31	4	18·2	154	14½	
32	6	16·8	243	14½	
33	7	25·2	252	14	
34	8	25·2	254	14	
35	9	29·4	280	14½	
36	10	35·8	364	13½	
37	11	21·3	420	12½	
38	12	21·0	382	13½	
39	13	49·0	322	13½	
40	15	49·0	714	12	
41	16	33·0	1036	11½	
	Grading Points				
1	15	8·5	92	15	Group 3.
10	15	9·2	96	15	
11	15	19·5	108	15	
13	14½	10·0	108	14½	
2	14½	9·9	120	14½	
8	14½	13·0	156	14½	
9	14½	11·0	164	14½	
16	14½	19·0	209	14½	
43	14	20·0	207	14	
44	14	17·6	209	14	
3	13	27·0	348	13	
14	12½	22·0	798	12½	
45	12	27·9	625	12	
15	11	26·8	968	11	
4	10	16·5	980	10	
12	11	27·4	984	11	

EXPLANATION OF TABLE.

Column 1. The tongue grading of samples indicated by the Honey Export Control Board: In Group 1 the grading is based on 100 per cent. for finest grain and 1 per cent. for coarsest.

In Group 2 points were not allotted by the Honey Export Control Board, but the samples were in order of grading. In Group 3 points were allotted according to the present system of judging.

Column 2 gives the mean crystal size (length only), in microns.

Column 3 gives the mean crystal size (length only) of the largest crystals or aggregates in microns.

Column 4 gives the grading according to the present system. (In Group 3 columns 1 and 4 are the same.)

DISCUSSION OF RESULTS.

The results show that a close correlation exists between the mean of the aggregate crystals and grading points. Columns 3 and 4 are also comparable, but many more exceptions occur. It is to be noted that as a general rule a large average crystal size means that large aggregates exist, but the reverse is not necessarily true.

In a few cases the microscopic measurements do not agree with the gradings. This is exemplified by comparing, in columns 3 and 4, numbers 25 and 26; 16, 43, and 44; 14 and 45; and similarly numbers 23 and 24; 37, 38, and 39, in columns 3 and 1.

It must be borne in mind that a standard of grading does not exist. Tongue testing is arbitrary, and results are liable to fluctuate from day to day, though the allocation of points in column 4 was carefully done by comparing each honey with others in the groups. Therefore it is impossible to say which column is a true representation of the grain of the honey.

The advantages and disadvantages of each system can be summarized as follows:—

Tongue Grading.

(1) Unless very careful comparisons are made this method gives different results from day to day.

(2) The allocation of points is dependent on a mental standard set up by the previous honey samples tested.

(3) The system is rapid in operation, but becomes slow as soon as accuracy is required involving comparison with samples of approximately the same grade.

Microscopic System.

(1) The measurement of the aggregates or largest crystals gives grading results comparable with careful tongue testing.

(2) The process of measuring is slow compared with normal tongue testing, requiring from five to seven minutes per sample.

(3) Errors may arise from the small sample tested—*i.e.*, the few readings taken—but the variations are much less than by tongue testing.

(4) A standard (of measurement) exists for all samples.

It will be observed from the table that the tongue is not very sensitive, for a difference of 100γ is not sufficient to separate two honeys, (see 31, 32, and 35), and, conversely, honeys of approximately the same measurement may be in three different grades (see 21, 31, and 35). On the other hand under grading conditions measurements by the microscope will not vary by more than 50γ for the same honey.

A suggestion has been made that standards be adopted for use with the present tongue grading, and for this purpose A1 sugar and Cerebos salt have been proposed. Examinations of these substances have given the following results: A1 sugar varies in size with each consignment, from 432γ to 840γ for the mean of the crystals, and from 826γ to 1030γ for the mean of the largest crystals. Similarly Cerebos salt varies from 280γ to 390γ for the mean of the largest crystals and aggregates. It is evident that the use of these substances as standards is impracticable, mainly because they vary in particle size and partly because their texture is not comparable with that of honey.

CONCLUSION.

The determination of the average length of the largest crystals or aggregates of honey provides a system of grading honey grain which is more accurate than the present tongue-testing method.

SOME TARANAKI PASTURES IMPROVED BY TOP-DRESSING WITH POTASH.

RESULTS OF PASTURE TOP-DRESSING EXPERIMENTS IN TARANAKI.

W. J. McCulloch, Fields Superintendent, Palmerston North, and J. M. Smith, Instructor in Agriculture, New Plymouth.

WITHIN the last few years the results of a number of observational top-dressing trials fairly widely distributed throughout Taranaki have definitely demonstrated that the supply of phosphate is not the only factor controlling grassland production over a large proportion of that province, but that the addition of potash is also very important.

CONCLUSION BASED ON FIELD TRIALS.

Such a conclusion has been arrived at after very careful observation of trials wherein potash and phosphate singly and in combination have been applied. In practically all trials in North Taranaki the evidence to date clearly indicates that the customary expenditure on phosphatic fertilizer would be less profitable than an equal expenditure on a fertilizer containing both potash and phosphate.

Whether the explanation is that there has always been a deficiency of potash as well as of phosphate in Northern Taranaki soils, or a recently created deficiency of potash mainly brought about as a result of unbalanced manuring—*i.e.*, the use of phosphate only—over a lengthy period, can only be conjecture, but the fact remains that in top-dressing on a large number of farms in Taranaki to-day the use of potash is as important as that of phosphate.

It is generally recognized that the production of dairy-produce makes a fairly heavy demand on soil fertility, and any neglect to replace the drain may sooner or later result in bringing into prominence certain soil deficiencies. In order to obtain information on such points, a series of simple pasture top-dressing trials were laid down throughout Taranaki in common with other districts in New Zealand.

The top-dressing materials used in these trials were superphosphate, 30 per cent. potash and lime separately and in combination.

Taranaki farmers are familiar with the marked phosphate responses which invariably occurred in the early days of top-dressing with slag or superphosphate, and the position to-day is that the inclusion of potash is giving just such outstanding results, although to-day there is the difference that the addition of potash changes a medium to good pasture to an extremely good one, whereas previously the addition of phosphate changed a poor or fair sward to a good one.

The knowledge that on certain pastures potash is one of the limiting factors will explain to many farmers the perplexing position where, despite liberal phosphatic dressings, pastures may be proving difficult to maintain at a steady standard of production or may even tend to decline.

While experimental work to date in Taranaki discloses certain important facts in connection with the use of potash it has been decided to prosecute the work further in an endeavour to obtain accurate detailed measurements of the economic value of applying potash.

RECOMMENDATION.

However, in the meantime, the data already to hand indicate that on those farms where ample dressings of phosphate fail to maintain the pasture at a reasonably high standard, serious consideration should be given to the inclusion of potash with phosphates. The writers recommend the use of not less than 1 cwt. of 30 per cent. potash per acre, even although for financial reasons it means reducing the usual amount of phosphate applied. Where two dressings of fertilizer are being made annually, the potash should for preference be combined with the autumn (March to May) dressing on grazing pastures, or as a spring dressing for hay or silage paddocks.

RESULTS CONFINED TO LIMITED AREA.

The work already carried out in Taranaki indicates that potash is generally important on the intensively farmed land in that block of country lying to the north of a line between Opunake and Stratford (and extending to Toko) and west of a line between the Stratford district and Urenui South of this area potash effect is less consistent and generally less pronounced, although it is certainly worth trial in an experimental way as suggested below.

Future investigation will more clearly define the boundaries within which good responses are definite. In the meantime it is recommended that farmers within the boundaries mentioned should at least try the effect of a strip of 30 per cent. potash at not less than 2 cwt. per acre, or muriate of potash at not less than 130 lb. per acre, in addition to phosphate, across certain pastures where phosphate alone has been in use over a period of years. Such a trial would prove convincing to those interested, and would also assist generally in furthering future investigation to be carried out by the Department of Agriculture. The quantity suggested for trial purposes—viz., not less than 2 cwt. of 30 per cent. potash or about 130 lb. of muriate of potash, may seem heavy and costly. This quantity is suggested because it is likely to give a definite result easily visible to the eye if response does occur. It does not follow that this quantity is necessarily the most economic, but for trial purposes the effects of smaller quantities, although they may be quite profitable, will be more difficult to observe.

IRRIGATION IN CANTERBURY.

REPORT BY ROBERT L. JAMES REVIEWED.

F. W. HILGENDORF, Canterbury Agricultural College, Lincoln

THE report of Mr. James, Lecturer in Engineering at Canterbury Agricultural College, on certain irrigation experiments in Canterbury during 1933, appeared in the *Journal of Science and Technology*, Vol. XV, No. 4. It is a detailed technical paper of great value as a record of the first exact experiments on irrigation ever conducted in Canterbury, and of one particular trial which is the most elaborate that has ever been conducted in New Zealand. The work was undertaken on the initiative of the Lands Department, of the Canterbury Chamber of Commerce, and of the Canterbury Progress League, but most of it was carried through only by Mr. James's devotion and enthusiasm.

The description covers six experiments of different degrees of complexity, distributed between Oxford and Ashburton All were designed to measure the difference in carrying-capacity between the irrigated and non-irrigated areas. There were usually from four to six plots fenced in, and half of these were irrigated and half left in the natural state, so as to measure the increased carrying-capacity in sheep days.

The soils were tested for physical properties and compared with irrigated soils elsewhere, tables are given for the conversion of requirements of one kind of stock into those of another, so as to place all the trials on a common basis; and correction factors for incomplete watering are explained. Careful records were kept of stock movements, rainfall, depth of water applied and costs of construction on the farm. These costs are estimated at rates for hired labour and implements. No costs of water at the farm boundary are considered, since in all cases the water was supplied free by the controlling authority.

OUTLINE OF EXPERIMENTS.

The following are some details of the experiments :—

HORORATA.

About 6 acres of stony soil were sown in permanent grass, and fenced into six plots of which three were irrigated and three were left dry. No levelling was done: Head ditches and distributing ditches were ploughed out and trimmed by hand. The total cost of this was £1 5s. per acre. The figure is unusually high partly because only a small area was treated, and partly because the small quantity of water available (only one-fifth of a cusec) necessitated the forming of many more ditches than usual. The total water applied varied from 7 in. to 15 in. on different plots. The non-irrigated plots carried an average of 1·1 ewe hoggets in March and April, while the irrigated plots carried an average of 7·1 sheep during the same period. The effect of the watering was to allow the carrying of 6 more sheep per acre during two critical months.

OXFORD.

Twenty acres being ploughed were roughly levelled by harrows, and shallow banks to make border dykes were thrown up by means of a home-made ridger. The total cost of gates, weirs, ditches, banks, and

levelling came to 12s. 6d. per acre. Six plots were formed, of unequal areas, but three were watered and three unwatered. Perennial Canterbury rye-grass was cross drilled on 31st December, Five inches of water were given in two applications, and the plots were grazed chiefly by store lambs in April and May. All were sent away fat. The non-watered plots fattened 1·3 lambs per acre, and the watered plots fattened 9 lambs per acre.

MOTUKARARA.

This is a dairy farm of 102 acres on land occasionally flooded by Lake Ellesmere. In its natural state the country is rushes and salt weed. Water supplied by artesian wells from 90 ft. to 180 ft. deep is used firstly to leach out lake salt deposits, but chiefly to maintain a sward of grass during the dry season of the year. It takes one man three hours per week to look after the irrigation ditches. Five fields totalling 76 acres were under observation. They carried on the average a cow to 2 acres during four months of the autumn. Adjoining fields carried no stock during the same period.

SOUTHBRIDGE.

On light stony land at Oakleigh about 4 acres were fenced into four plots, two of which were irrigated and two not irrigated. The pasture was old rye-grass and subterranean clover, very open. The cost of distributing-ditches, &c., was £1 2s. per acre, which is much higher than it would be if a larger area were served. About one cusec of water was available, and water was applied thrice to a total depth of 7 in. Southdown rams were used in the trial. The watered plots during the month of April, which was very dry, carried nearly 4 of these sheep per acre, while the unwatered plots carried nothing.

SEAFIELD.

This experiment was laid out on light wheat land near Ashburton. The property belongs to the Lands Department, which provided the money for the trial, and unemployed labour was largely used. Mr. Flay, of Lincoln College, advised on cultivation and sowing.

The trial is described as one of the most complete experiments in irrigation that have ever been conducted in New Zealand. An area of about 70 acres was irrigated by various means.

A. Border Dykes.—Here the ground was ploughed, graded, and levelled, and banks were moulded up to form watered beds 5 chains long by 60 links wide. Elaborate races and gates were constructed, every facility being provided for applying the water quickly and cheaply, and for securing an accurate measure of the water used. Allowing for standard rates for the hire of horses, tractors, graders, scoops, &c., the purchase of high-grade timber for boxes and gates, the formation of banked races above ground-level, and of concrete measuring-weirs, &c., and using unemployed labour at 6s. 5d. per man per day, the cost worked out at about £9 10s. per acre. This high cost is inseparable from the border-dyke system, and especially in one laid down for experimental investigation, but it is a capital expenditure—maintenance costs will be negligible and the costs of application of water will be very low. After the ground was levelled and banked it was sown with

a mixture of rye-grass, cocksfoot, and red and white clovers, all of permanent strains except the red clover. Twenty-eight acres of the area were then fenced into fourteen sections of 2 acres each, of which seven were watered and seven left dry, so that the carrying-capacity of the land watered and unwatered could be measured.

The grass was sown on 1st January, 1933 ; watering started on 24th February, and a total of 7·5 in. of water was applied. Lambs were turned on to the grass on 21st April. From then until 13th June, lambs were carried and fattened at the rate of 5·4 lambs per acre on grass alone, on the watered sections. The grass on the unwatered sections grew so poorly that it could not be grazed at all, and carried no stock.

B. Border Ditches.—An adjacent 40 acres of matted browntop was watered by the much cheaper method of ploughing ditches along the highest parts of the field, blocking them at intervals, and allowing the water to flow over the grass. The cost of this worked out at 13s. 6d. per acre for head races and distributing-ditches.

It must be remembered that this was the poorest type of grass, of very low carrying-capacity in the best of circumstances. From January to June, 1933, the unwatered parts of the block carried an average of 0·75 dry sheep to the acre. The 40 acres of watered land carried an average of 3·5 sheep to the acre.

SUMMARY.

Six irrigation experiments in Canterbury during 1933 were described. Costs of water at the farm boundary are not considered.

Costs of construction of races, boxes, gates, &c., on the farm are given. The costs are higher than normal owing to the small area, sometimes only 4 acres, served by the races. These costs are incurred once for all. They are not annual expenditures. The amount of water applied was measured in all cases It averaged about 7 in.

Watered and unwatered sections adjacent to each other were used to measure the effect of irrigation.

The effect of irrigation on grass-growth was measured by the extra number of sheep (in one case cattle) carried per acre during the period of the experiment.

RESULTS.

1. Hororata.—Initial cost £1 5s. per acre : Carried 6 extra dry sheep per acre during March and April.

2. Oxford.—Initial cost 12s. 6d. per acre : 7·7 extra lambs fattened per acre in April and May.

3. Motukarara.—Initial cost not known : Shallow artesian wells. One extra cow carried per two acres during four autumn months.

4. Southbridge : Initial cost £1 2s. per acre : Carried 4 extra rams per acre during April.

5. Seafield (Border Dyke).—Initial cost £9 10s. per acre (experimental) : Fattened 5·5 extra lambs per acre in May and June.

6. Seafield (Border Ditch).—Initial cost 13s. 6d. per acre : Carried 2·6 extra dry sheep per acre from January to June inclusive.

Several of the experiments were carried out on poor grass where the best results could not be expected.

The reviewer wishes to express his admiration of Mr. James for having secured such results in the face of great difficulties, and with the most meagre financial resources. He has shown that from the agricultural viewpoint, irrigation in Canterbury can be highly advantageous. When the cost of water at the farm boundary is known, the work of Mr. James will allow an exact estimate of the profitableness of irrigation in Canterbury.

EXPERIMENTS ON CONTROL OF SOME CEREAL DISEASES BY SEED-DUSTING.

J C. NEILL, Field Mycologist, Mycological Laboratory, Plant Research Station, Palmerston North.

I. THE CONTROL OF OAT-SMUT.

THE experiments herein recorded were designed to afford information on the relative value of certain seed-dusting materials for the control of oat-smut. Samples of commercial lines of oats were shaken in a closed container with each dust at the rate of 4 oz per bushel, any excess dust being subsequently removed by screening. Ten to fourteen days after dusting the seed was sown by hand in four rows one rod long, 100 seeds per row, a similar quantity of seed from the same sample being sown without any treatment. At maturity the resultant plants were pulled, examined, and recorded. Both *Ustilago avenae* and *U. levis* were present in most samples, but, since rapid field differentiation between the two species is difficult and at times uncertain, and since no difference was apparent in their reaction to the treatments, both were recorded under the general title of oat-smut. No significant differences in plant vigour could be detected at any stage between any of the treatments and the untreated controls.

Table 1 records the results using three organic mercury and three copper dusts on two lines of oats. Table 2 records the results when using two organic mercury dusts on thirty-six different lines.

Table 1.

Variety.	Plants harvested per 100 Seeds sown.													
	Control		Agrosan G		Ceresan New.		Ceresan.		Copper Carbonate (20% Cu.).		Copper Carbonate (51% Cu.).		Copper Oxychloride (53% Cu.).	
	Total.	Smutted	Total.	Smutted.	Total.	Smutted.	Total.	Smutted.	Total.	Smutted	Total.	Smutted.	Total.	Smutted
		%		%		%		%		%		%		%
Dun, Sample 38 ..	84	23·7	89	2·0	84	0·0	85	0·0	87	4·0	89	4·7	88	2·8
Algerian, Sample 37 ..	81	3·0	92	1·1	88	0·0	81	0·0	86	2·0	90	3·0	84	0·6

SUMMARY OF RESULTS.

The results indicate that copper carbonate and copper oxychloride dusts are not efficient preventives of oat-smut. Of the organic mercury dusts Ceresan and Ceresan New gave almost perfect control

Table 2.

Variety.	Plants harvested per 100 Seeds sown.					
	Control.		Agrosan G.		Ceresan New.	
	Total.	Smutted.	Total	Smutted.	Total.	Smutted.
		Per Cent		Per Cent		Per Cent.
Algerian						
Sample 1	87	0·0	82	0·0	86	0·0
Sample 2	86	0·6	87	0·0	90	0·0
Sample 16	71	1·4	68	0·0	73	0·0
Sample 17	71	0·0	68	0·0	66	0·0
Sample 18	79	0·6	88	0·0	87	0·0
Sample 19	78	0·0	75	0·0	81	0·0
Sample 20	72	0·7	81	0·0	77	0·0
Sample 21	74	0·6	78	0·0	78	0·0
Sample 22	71	10·5	86	0·5	78	0·0
Sample 23	83	20·5	82	0·0	75	0·0
Sample 25	60	1·6	61	0·0	65	0·0
Sample 26	62	0·0	62	0·0	65	0·0
Sample 28	61	0·0	72	0·0	58	0·0
Sample 30	71	10·4	74	0·6	78	0·0
Sample 31	85	2·1	80	0·6	83	0·0
Sample 36	75	0·0	88	0·0	78	0·0
Sample 35 .. .	77	0·0	68	0·0	70	0·0
Sample 33	75	0·0	79	0·0	75	0·0
Garton						
Sample 3 . ..	79	2·6	75	0·0	70	0·0
Sample 4	62	1·6	64	0·0	68	0·0
Sample 5	68	3·0	71	1·4	67	0·0
Sample 6 .. .	76	0·6	70	0·0	87	0·0
Sample 7	69	6·5	79	0·0	73	0·0
Sample 24 .. .	58	0·9	63	0·0	64	0·0
Sample 27	74	43·0	79	1·8	71	0·0
Garton (clipped)						
Sample 29	81	10·5	83	1·2	83	0·0
Garton						
Sample 34	84	0·0	76	0·0	87	0·0
Dun						
Sample 8	74	3·3	85	0·0	72	0·0
Sample 9	73	25·2	75	0·5	80	0·0
Sample 10	79	16·0	82	0·0	79	0·0
Sample 11	80	10·6	86	1·1	79	0·0
Sample 32	76	25·3	94	1·1	78	0·0
Black Tartar—						
Sample 12	66	37·6	80	2·0	57	0·9
Sample 13	64	39·7	66	0·0	59	0·0
Sample 15	74	12·1	80	3·1	81	0·6
Black Supreme—						
Sample 14	61	15·4	56	1·8	58	0·0
Mean, 36 lines ..	73·2	8·4	79·1	0·45	74·3	0·04

of smut with a slight increase in the number of established plants as compared with the controls. Agrosan G. gave a lesser measure of smut-control, but a still higher establishment of plants.

II. THE CONTROL OF BARLEY DISEASES.

The object of the present experiments was to determine whether some one of the modern dust treatments might not with advantage be substituted for the formalin and bluestone steeps at present in general use for "pickling" barley seed. Samples of eight lines of

barley seed were used, each treatment being sown in four rows one rod long at 100 seeds to the row. The dusting was carried out by shaking the seed in a closed container with a surplus of the dust, being then screened to remove any not closely adhering to the seed. This method was chosen as representing in miniature the action of most continuous-action power dusting machines.

At harvest-time the plants were individually pulled, examined, and recorded. No visible differences in vigour appeared between the treatments at any stage of growth.

Table 3 indicates the results.

Table 3

Treatment.	Plants per 100 Seeds sown.	Disease. Per Cent. Smut. Loose.	Covered	Per Cent. Stripe.	Sample.
Control (untreated) ..	73	6·7	0·3	5·7	Cape No. 8
Hot-water (5 hrs. at 60° plus 5 min. at 127° F.)	71	0·0	0·0	0·0	Cape No. 8.
Ceresan New ..	76	2·0	0·0	0·0	Cape No. 8
Ceresan	77	1·3	0·0	0·0	Cape No. 8.
Agrosan G.	83	3·6	0·0	0·3	Cape No. 8
Copper carbonate (No. 1, 20% Cu.)	85	1·8	0·0	1·6	Cape No. 8
Copper carbonate (No. 2, 51% Cu.)	87	3·2	0·0	1·8	Cape No. 8.
Copper oxychloride (Smutol), (53% Cu.)	80	4·0	0·0	3·4	Cape No. 8.
Control (untreated) ..	90	0·0	2·8	0·0	Chevalier No. 6
Ceresan New	90	0·0	0·0	0·0	Chevalier No. 6
Ceresan	81	0·0	0·0	0·0	Chevalier No. 6.
Agrosan G	82	0·0	0·0	0·0	Chevalier No. 6
Copper carbonate (No. 1)	87	0·0	1·4	0·0	Chevalier No. 6
Copper carbonate (No. 2)	88	0·0	0·6	0·0	Chevalier No. 6
Copper oxychloride (Smutol)	95	0·0	1·3	0·0	Chevalier No. 6.
Control (untreated) ..	85	0·0	0·3	19·6	Cape No. 1.
Agrosan G	84	0·0	0·0	0·6	Cape No. 1
Ceresan New	91	0·0	0·0	0·0	Cape No. 1.
Control (untreated) ..	79	2·2	0·3	18·6	Cape No. 2.
Agrosan G.	73	0·7	0·0	0·3	Cape No. 2.
Ceresan New	82	1·5	0·0	0·0	Cape No. 2.
Control (untreated) ..	77	2·6	1·9	15·5	Cape No. 3.
Agrosan G.	83	2·7	0·0	0·0	Cape No. 3.
Ceresan New	82	1·0	0·0	0·3	Cape No. 3.
Control (untreated) ..	91	2·7	0·3	0·0	Cape No. 4.
Agrosan G.	84	2·1	0·0	0·0	Cape No. 4.
Ceresan New	84	2·4	0·0	0·0	Cape No. 4.
Control (untreated) ..	78	0·0	0·3	2·5	Cape No. 5.
Agrosan G.	74	0·0	0·0	0·0	Cape No. 5.
Ceresan New	81	0·0	0·0	0·0	Cape No. 5.
Control (untreated) ..	79	0·0	0·0	1·6	Cape No. 7.
Agrosan G.	78	0·0	0·0	0·0	Cape No. 7.
Ceresan New	83	0·0	0·0	0·0	Cape No. 7.

SUMMARY OF RESULTS.

Loose-smut was eliminated only by hot-water, though reduced somewhat by all the dusts. Covered-smut and stripe disease were reduced by the copper carbonate and copper oxychloride dusts, but the former was completely, and the latter nearly completely, controlled by the organic mercury dusts Ceresan, Ceresan New, and Agrosan G.

STATISTICS OF THE NEW ZEALAND SEED TRADE, 1925-33.

THE accompanying tables concerning the New Zealand seed trade are drafted from official data Some matters which seem to call for brief comment are–

Table 1, Export 1933.—The breaking-up of the totals for certain seeds into certified and uncertified was not commenced until May, so that, as indicated, the totals shown for the various classes are for eight months only

Red clover. 750 tons to United Kingdom and 836 tons to Australia—the only buyers

White clover: Certified—United Kingdom, 14 cwt, Australia, 31 cwt; United States of America, 11 cwt. Uncertified—United Kingdom, 74 tons, Australia, 4 tons.

Table 1.—Grass and Clover Seed Export, 1933.

—	Eight Months, May–December.		Totals, 1933	
	Cwt	£	Cwt	£
Red clover	..	..	3,168	14,953
White clover—				
Certified	57	726	..	..
Uncertified	1,570	11,261	..	..
Total	..	..	1,801	13,844
Other clover	..	..	1,067	3,044
Brown-top—				
Certified	982	4,122	..	..
Uncertified	521	2,525	..	..
Total	..	..	1,767	8,049
Chewings fescue	..	..	10,337	34,070
Crested dogstail	..	..	3,472	9,114
Cocksfoot—				
Certified	1,026	3,005	..	..
Uncertified	1,338	3,810	..	..
Total	..	..	3,977	13,215
Perennial rye-grass—				
Certified	2,008	2,710	..	..
Uncertified	13,978	16,150	..	..
Other rye-grass—Italian, &c ..	18,595	21,889	..	..
Total rye-grass	..	..	44,124	54,660
Other grass	..	..	1,676	2,749
Total, 1933	..	..	80,389	153,698
Total, 1932	..	..	34,359	109,632

Brown-top: United Kingdom, 560 tons; Australia, 160 tons; Canada, 7 tons; United States of America, 4 tons.

Chewings fescue: United States of America, 590 tons; United Kingdom, 293 tons; Canada, 57 tons; Australia, 8 tons.

Crested dogstail United Kingdom, practically sole buyer, 156 tons

Cocksfoot: United Kingdom, 111 tons (certified, 34 tons; uncertified, 61 tons); Australia, 84 tons (certified, 14 tons; uncertified, 3 tons) A substantial increase in the export of cocksfoot is shown and of the total of 200 tons, 130 tons was shipped in the first six months of the year when prices were low For 1934 it is anticipated that short supply and high prices will result in a small export only

Rye-grass: United Kingdom, 1,440 tons (certified, 75 tons; uncertified, 629 tons, Italian, &c., 735 tons) Australia, 720 tons (certified, 24 tons, uncertified, 56 tons; Italian, &c, 645 tons) United States of America, 15 tons uncertified, 9 cwt certified. Of the United Kingdom purchase, 70 tons was made in December, when the price of certified rye-grass was at the lowest level since the inception of the certification scheme Of the total of 2,200 tons export, November and December shipments accounted for 800 and 700 tons respectively— this in response to a heavy demand from England following a shortage in the Irish crop Whether the New Zealand seed, mostly of an inferior strain, will provide a satisfactory substitute remains yet to be seen.

Table 2, Imports, 1933, calls for no comment.

Table 3, Exports, 1925–33.—

Clovers Fluctuations in clover export follow fairly well the amount of seed in supply in overseas markets For instance, a red-clover failure in Canada in 1927 was followed by a record export of that seed to Canada and Great Britain. Again, in 1930, Canada and Australia shared equally the export, whereas in 1931-32 Canada was not a buyer, the United Kingdom and Australia sharing the total. For white clover the United Kingdom is the chief buyer, Australia being the second.

Table 2.—Seed Imports, 1933

	Cwt.	£		Cwt	£
Red clover .	578	2,146	Timothy.. .	3,201	4,064
White clover ..	279	1,645	Other grass ..	567	1,861
Alsike clover ..	659	1,976	Total grass and clover	7,797	25,476
Other clover ..	866	4,348	Rape and kale ..	5,354	11,262
Cocksfoot	..	.	Turnip and swede	5,120	22,088
Lucerne	224	564			
Paspalum	1,212	7,987	Total, 1933 ..	18,271	58,826
Poa pratensis ..	..	..			
Rye-grass	211	285	Total, 1932 ..	22,153	75,873

Table 3—Grass and Clover Seed Exports, 1925–33 (in Hundredweights).

—		1925	1926	1927	1928	1929	1930	1931	1932	1933.
Red clover		4,253	4,657	9,628	1,195	991	2,393	3,221	2,485	3,168
White clover		647	2,115	2,388	835	1,358	2,039	2,930	1,726	1,801
Other clover .		985	717	928	360	690	794	261	521	1,067
Brown-top .		514	475	301	1,131	3,473	4,697	2,496	2,073	1,767
Chewings fescue .		7,483	13,923	17,418	17,124	16,847	12,806	14,910	13,155	19,337
Crested dogstail		3,985	2,309	5,434	4,844	4,363	4,656	3,180	887	3,472
Cocksfoot .		*	*	*	750	1,521	764	2,967	1,862	3,977
Perennial rye-grass .		23,241	29,546	50,162	20,581	25,947	5,954	9,486	10,274	44,124
Other grass ..		5,071	4,685	1,489	3,157	3,289	2,815	1,701	1,782	1,676
Totals .	Cwt.	46,159	58,427	90,748	50,277	58,482	36,918	41,158	34,065	80,389
Totals ..	£	15,509	203,798	257,136	162,603	185,270	167,979	155,969	110,763	153,698

Brown-top · The export increased from 25 tons in 1925 to a peak of 230 tons in 1930 (United States of America, 130 tons),† when, following the imposition of a duty of 40 cents per pound by the United States of America, the trade—a very promising one—has fallen off considerably. It is of interest to note here that the

* Included in "Other grass."

† Importations into United States of America in 1930 (254 tons) includes late 1929 shipments.

40 cents represented the difference between production costs on the Pacific Coast and in New Zealand. Following 1930 the American purchases fell in 1931 to 73 tons, in 1932 to 50 tons, and in 1933 to 4 tons only. Britain's largest annual purchase prior to 1928 was 1 ton, to be followed by 12 tons in 1929, 50 in 1930, 33 in 1931, 64 in 1932; and 1933, 56 tons.

Chewings fescue has for many years been the Dominion's most consistently large export seed, with America as the chief buyer, although Britain's requirements are steadily increasing.

Cocksfoot: The export shows an increasing tendency, and, given average productive seasons, is a promising export commodity

Rye-grass: Up to 1929 rye-grass showed the largest annual total in quantity, but for 1930–32 very reduced totals are shown. The record for 1927 was due to an Irish failure, which was followed by heavy purchases by Great Britain and the United States of America. Up to this time the United States of America had been a consistent purchaser of New Zealand rye-grass, but following 1928 (170 tons) the trade has fallen right off to nil in 1932 and 15 tons in 1933, of which 10 tons were Italian. Australia has been the most consistent, although not the largest, purchaser

Table 4, Imports, 1925-33 -

Clovers: Generally a falling tendency is shown

Cocksfoot Since the peak of 780 tons in 1926, the importation has fallen away until in 1933 there is a nil return The export figures for cocksfoot provide an interesting comparison Staining under the Seeds Importation Act commenced the process of elimination of Danish seed in this country, while knowledge of strain variations and low prices have completed it. Nevertheless, with the high prices ruling for New Zealand seed, Danish seed will most assuredly be imported during 1934 - probably not in any great quantity The antipathy towards stained seed still exists– not necessarily because it is Danish, but because it is artificially marked -but were it not for this fact seed would be imported in quantity this year

Table 4 --Seed Imports, 1925–33 (in Hundredweights).

——	1925.	1926	1927	1928	1929	1930.	1931	1932	1933.
Red clover	6,451	8,285	2,657	762	1,178	736	167	1,362	578
White clover				1,848	1,368	461	24	336	279
Alsike				2,898	1,517	2,032	81	961	659
Other clover				1,370	765	1,068	609	724	866
Cocksfoot	10,091	15,616	5,619	9,152	4,199	232	71	185	Nil
Lucerne	1,027	575	527	17	50	291	37	687	224
Paspalum	1,378	1,717	1,940	3,026	2,615	1,370	572	1,503	1,212
Poa pratensis	*	*	*	51	249	201	50	110	Nil
Rye-grass	40	334	69	20	795	4,501	348	268	211
Timothy	4,142	1,989	2,905	4,965	2,903	2,552	1,786	2,638	3,201
Other grass	3,004	3,604	1,741	1,813	1,521	511	512	1,016	567
Total grass and clover Cwt.	26,133	32,120	15,458	25,922	17,160	13,958	4,260	9,790	7,797
Total grass and clover £	122,754	143,065	63,793	112,598	79,456	37,866	13,593	31,241	25,476
Rape and kale	3,741	4,124	3,437	3,562	4,587	5,416	4,567	5,501	5,351
Turnip and swede	4,153	5,038	4,751	5,045	5,714	4,094	4,059	6,482	5,120
Totals Cwt	34,027	41,282	23,646	34,529	27,461	23,468	12,886	21,773	18,271
Totals £	154,979	179,257	106,472	149,008	124,579	95,277	43,844	75,873	58,826

* Included with "Other grass."

Paspalum is one of the larger items on our list of the imported grass and clover seeds, but with proper methods of harvesting in New Zealand it is thought that much of this importation could be replaced by locally grown seed. *Poa*

pratensis, judging by the quantity of seed imported, is not an important constituent of New Zealand grassland. In rye-grass—the annual importation is small—the 225 tons shown for 1930 was imported following over-production in Ireland with extremely low prices. Australian merchants bought heavily from Ireland that year, and in consequence their purchases of New Zealand seed were the lowest for the nine-year period under review. Timothy—of the grasses and clovers—is imported in greatest quantity with a normal fluctuation. Rape, kale, turnip, and swede seed importations show a rising tendency.

Table 5.—Garden Seeds Imports, 1925–32.

—		1925.	1926.	1927.	1928.	1929.	1930.	1931.	1932.
		£	£	£	£	£	£	£	£
Flower and vegatable		39,500	39,647	47,137	38,667	48,489	46,486	30,209	26,680

Peas and Beans Exports, 1925–32.

Peas . .	Centals	128,937	109,619	162,649	220,954	173,792	125,655	68,780	105,814
	£	102,301	90,167	151,157	185,705	120,522	85,915	56,897	80,498
Beans ..	Centals	390	938	283	127	250	283	695	470
	£	312	798	558	308	493	602	1,813	1,011

—*N. R. Foy, Seed Testing Station, Palmerston North.*

IMPROVEMENT IN EXTERNAL TRADE.

THE export season is rapidly approaching its zenith; February, March, and April normally being the peak months of the year. Exports (excluding specie) during February, 1934, were valued at £6,249,026 in New Zealand currency, equivalent to £4,999,000 on a sterling basis—the highest monthly total in New Zealand currency since January, 1930, and, on a sterling basis, since March, 1930. The value of exports is still, however, considerably below the totals recorded during the peak years, the value during February of 1928 and 1929, for example, being £7,842,822 and £8,056,083 respectively. Nevertheless the position shows a very marked improvement when compared with 1931, 1932, and 1933. The following comparison of the Dominion's main exports in February, 1933 and 1934, is of interest in this connection:—

Commodity.	February, 1933.		February, 1934.	
	Quantity.	Declared Value.	Quantity.	Declared Value.
	Cwt.	£ (N.Z.)	Cwt.	£ (N.Z.)
Butter	137,735	593,338	389,502	1,388,806
Cheese	183,236	455,353	180,438	432,989
Lamb	328,532	778,303	278,771	824,328
Mutton	101,992	144,634	99,742	167,024
	Bales.		Bales.	
Wool	140,500	1,210,720	139,987	2,671,362

The striking improvement in the return from wool exported is the outstanding feature of February export statistics. Lamb and mutton also show a considerable improvement as compared with the position twelve months ago; the increased return from exports of butter, however, being purely a reflection of an abnormally heavy quantity exported during February of this year.

The recorded value of imports (excluding specie) during February was £1,592,689, equivalent to £1,945,000 on a New Zealand currency basis, and to £1,556,000 on a sterling basis. The value of imports during the month was slightly below that for the corresponding month of last year.

—*Monthly Abstract of Statistics.*

SEASONAL NOTES.

THE FARM.

Weaknesses in Pasture Utilization.

INADEQUATE supplies of feed to supplement that available directly from grassland in winter and early spring commonly are associated with two distinctly undesirable results.

The most obvious of these results is a greater incidence of stock disease. Disease in many forms is levying a heavy toll on live-stock returns, and observation and investigation point to the conclusion that faulty feeding, especially in the winter and early spring, materially increases the ravages of disease.

Less obvious, though possibly not less serious, is the effect of unduly scant reserves of feed for winter and early spring upon grassland itself This effect arises from the fact that grazing too often or too closely in the early spring in the manner necessitated when reserves of feed are insufficient has a decided influence in changing the botanical composition of pastures and in reducing the subsequent yield of those valuable species, such as perennial rye-grass, which are characterized by early growth In general, inadequate provision of feed to supplement the pastures in winter and early spring leads both to overgrazing in the spring and undergrazing in the summer – a pasture-management position widely obtaining in New Zealand The influence of management of this nature was illustrated in recent research in Britain by Martin G. Jones, who subjected portions of an old pasture to differential treatment After two seasons one portion which was overgrazed in the spring and undergrazed in the summer, as in previous years, remained fairly constant in composition and contained 1·7 per cent of perennial rye-grass In another similar portion of the same pasture, lenient treatment in the spring resulted in the amount of perennial rye-grass increasing to 19·4 per cent Incidentally, importance attaches to the fact that in the same investigation close grazing of plots throughout the growing-season, and particularly in the spring, resulted in a remarkable increase in the content of white clover—from 5·8 per cent to 48·6 per cent. in one instance, and from 3 per cent. to 53·5 per cent in another instance. Further, in the same investigation, plots which constantly had been overgrazed in the spring and undergrazed in the summer contained 9·3 per cent. and 10·4 per cent. respectively of useful plants, whereas originally similar plots, after two seasons of controlled grazing, contained 48 per cent. and 64·8 per cent. of useful plants. These striking results exemplify to what an extent at times grazing management can become the directing force relative to the composition of a sward Significance attaches to the fact that all the changes specified above took place in the short period of two seasons, and that, apart from grazing management, conditions were similar

The influence of grazing management is exerted partially through differential weakening of the various species owing to variations in intensity of grazing at different times of the year: a species which grows when grazing is severe—*e.g.*, rye-grass—is likely to suffer much more drastic defoliation than one which is characterized by active growth when grazing is relatively lenient—*e.g.*, brown-top and sweet vernal.

Summed up, the method of grazing management—unfortunately very common in New Zealand—which involves overgrazing in the spring and

undergrazing in the summer tends to the suppression of perennial rye-grass and the dominance of species akin to brown-top and sweet vernal.

The solution of the problem of avoiding such an undesirable result lies along the lines—(1) of eliminating, as far as possible, critical defoliation of desirable species, and (2) of providing conditions which assist in recovery from the weakening effect of any critical defoliation which it is not practicable to avoid. By critical defoliation is meant that from which a species suffers most—which is determined not only by the intensity but also by the time of occurrence of the defoliation. Defoliation during the early growth of the season seems to be especially weakening.

Pre-winter top-dressing is a current measure of considerable value in minimizing the results discussed above. In the first place, it has been noted that the availability of plant-food plays an important part in the recovery of various species after being defoliated. Further pre-winter top-dressing may well reduce the severity of the defoliation at the critical season. This is because in many districts in which grassland is dominant appropriate top-dressing carried out in the April–May period may be expected to assist in the provision of feed for stock through the difficult July–September period. Quickly-acting phosphates applied in April or early May generally bring about an almost immediate increase in the growth of pastures. Often an increase in growth at this stage would result in stock entering upon the severe part of the year with greater strength and better bodily reserves, and, in addition, through much of the winter and early spring such autumn top-dressing will cause increased growth of grass.

Hence any farmers who may have to face a probable July–September shortage of feed should strive to their utmost to improve the critical feed-supply by top-dressing in April or May

That the number of farmers to whom this applies is extensive may be realized from the fact that a fundamental weakness in our life-stock industry is inadequate provision of feed for late winter and early spring Especially is it applicable to farmers who are wintering more stock than they have wintered recently.

Pre-winter top-dressing tends to minimize not only overgrazing in winter and early spring, but also undergrazing in summer : at the advent of summer the influence of pre-winter top-dressing is partially exhausted, and so it is less likely to cause in late spring and early summer the great rush of feed which at times follows early spring top-dressing and which readily leads to undesirable undergrazing

The fundamental justification for pre-winter top-dressing in preference to spring top-dressing with phosphates is summed up in the fact that it tends to even the rate of grass-growth throughout the year, and, as a rule, manures are used to best advantage on New Zealand grassland when they do this to the greatest possible extent. It is quite unsound to deduce from this that top-dressing alone can be employed satisfactorily to adjust the feed-supplies from season to season to meet the feed-requirements from season to season. The true position is merely that pre-winter top-dressing with phosphates disturbs less than does similar spring top-dressing the balance between seasonal feed-production of grassland and seasonal feed-requirements of stock. Actually it would seem from investigational work, which has been carried out at Marton and which is confirmed by field experience, that phosphatic top-dressing, whether carried out in the autumn or in the spring, increases instead of lessens the absolute difference between the growth in the period of low production and that in the period of high production of grassland. For instance, in 1930 at Marton the difference between the daily production in May–August and that in mid-November on land which had not been top-dressed was 107·1 lb., whereas the corresponding difference on land which had been top-dressed with phosphates

ranged from 128·9 lb. to 145·2 lb., according to the class of phosphate used and the date of its application. Incidentally, it is of practical importance that the smaller differences, due to top-dressing, between the period of high and of low production were associated with the less effective phosphatic top-dressing. In this instance phosphatic top-dressing invariably increased the gap between winter and summer production. This fact emphasizes the need for giving attention to the future provision of special feed to which reference is made later.

Treatment of Young Pastures.

Special care in the treatment of young pastures is advisable. The plants having been given proper opportunity to establish themselves, should neither be allowed to become long and productive of flower-heads nor be eaten down closely and continuously. To keep the growth suitably controlled, it is usually best to turn in a relatively large number of stock for a short time only. This method of grazing avoids the selective hard grazing of the most attractive species and the neglect of other species which is apt to occur in case of light stocking. Properly controlled stocking, which prevents undesirably rank growth during the youth of the pasture, leads to the stooling-out of the plants, and this gives a denser sward. Stock should not be grazed on young pasture if the ground is softened by rain, for trampling of wet, soft ground will lead to the killing-out of plants and poaching of the soil in such a manner as to lead to invasion by weeds. The damage from undergrazing of young pastures may readily become particularly serious when Italian rye-grass and red clover (at times called cow-grass) are prominent in the pasture— these temporary species outgrow, and, in consequence, if not controlled, weaken the slower valuable permanent species by shading.

Harrowing of Pastures.

Especially in difficult times, when the use of artificial fertilizer is being restricted, proper use of animal manure available on grassland in the form of droppings is particularly desirable Proper use calls merely for the inexpensive work of harrowing sufficiently to bring about thorough distribution, without which animal manure tends to harm instead of to benefit the pasture.

Pastures consisting of a matted growth usually call for relatively drastic harrowing amounting to cultivation, which aerates the surface layer and facilitates the subsequent development of youthful leafy growth. The considerable fertilizing-value of animal droppings may be gauged to some extent by the rankness of the growth in the vicinity of undisturbed droppings—rankness normally greater than would be caused by applying artificial fertilizer at the rate of many hundredweights an acre.

Future Provision of Special Feed.

At this season it is advisable to draw up a tentative programme of the work of the coming year in respect to the provision of special feed. Though such a programme is likely to be modified later, it is useful at this stage as the basis of decisions about such matters as the location of silage pits or trenches, fencing, and cultivation work, which should now be planned in order that labour may be devoted to it in good time during the next few months.

In general, the fundamental consideration relative to a programme of special feed provision is that the provision has, as a rule, been distinctly inadequate in the past.

In some instances there has been a tendency to place too much dependence upon the reserves of feed that can be built up by means of grass ensilage. Because of uncertainty about the weather of next season there is no certainty whatever that next summer will yield enough surplus grass-growth to give reasonably safe supplies of silage. Further, ensilage as

commonly practised fails in respect to the quality as distinct from the quantity of the supplementary feed often required at critical seasons. Fortunately, accumulated experience in these matters is leading to a wider recognition of the fact that, after making due allowance for the valuable role of ensilage, it is, as a rule, advantageous to grow special crops such as mangels, turnips, &c., for the purpose of assuring both adequate and suitable supplies of special feed to supplement that available from grassland during periods of low production.

Of seasonal importance in respect to such crops is the fact that the mangel—which with advantage could be grown much more extensively—when sown after grass, often gives the largest and most profitable crops as the result of ploughing about May Such ploughing allows for the thorough decay of the buried sod and results in a more fertile soil due partly to the rotted sod becoming well incorporated with it. If it is not practicable to plough at this stage, then it will be advisable in the spring to carry out either skim ploughing followed by deep ploughing or a disking of the sod before ploughing. The objective of these various measures is to secure a well disintegrated sod which not only means a greater supply of plant-food, but also removes the danger of the rise of moisture from the subsoil being checked

Autumn preparatory cultivation is also frequently worth while for such crops as potatoes, carrots, and lucerne, especially when these crops follow old pasture. Usually the first step in such cultivation should be skim ploughing, followed, possibly, by disking to break up the sod thoroughly and leave the ground in a suitable condition for the normal deep spring ploughing.

At this stage, in districts in which arable cropping is prominent, no opportunity should be missed of cultivating land for spring sowing, and the fact that lea land can at times be worked safely when adjoining similar land, which has been under the plough recently, is too wet is of assistance in keeping the implements idle as little as possible

The Cereal Crops.

The notes relative to cereal crops published last month cover generally matters calling for attention in April and May Some results of recent research work relative to the treatment of seeds of cereals are described elsewhere in this issue. Because of incorrect methods, seed treatment at times is ineffective in the control of disease, and at times causes serious injury of the seeds. Further information about correct methods of seed treatment may be obtained from district officers of the Fields Division

Autumn Utilization of Crops.

It seems at times to be overlooked that immature animals are less well able than mature animals to undergo hardships. For farm stock winter is often a time of hardship, and, because of their immaturity, calves and hoggets are likely to suffer severely unless they receive good attention. This fact should be taken into consideration not only during winter itself, but also during the period leading up to winter. Calves should be trained to eat such feed as hay and silage while they are still in good condition and before they have to live almost wholly on such feeds. Calves to which there takes place a timely gradual introduction to unfamiliar feeds will be spared the setback which sudden changes of the feed of animals, especially those in poor condition, are likely to bring about.

Similarly, hoggets should be given the best possible treatment ; before they have become low in condition they may well be given access to fodder crops from which they should, as a rule, be given a run-off on a suitable pasture—one which is short, clean, and fresh—and changes in their feed should be arranged gradually.

The trampling and firming of lucerne fields which result from grazing during autumn and winter should, as a rule, be avoided, especially if the stand of lucerne is a good one. The firming of the soil favours the ingress of grass and clover which in regions of medium to good rainfall are likely to be serious weeds of lucerne. Should a lucerne area already be badly infested by such plants, then it may be sound practice to utilize the area chiefly as a grazing-field from which it may be possible to obtain up to three cuts a year.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Late Harvesting.

In a few more weeks the harvesting of fruit generally will be finished for the 1934 season Very little difficulty should be experienced in packing late varieties owing to the fact that the colour does not have to be considered to such an extent as in the case of some of the mid-season varieties. However, there must be no relaxation in the careful handling of the fruit throughout the picking, grading, and packing of the later varieties. At the present time there is much promise of a heavy crop of Sturmer apples It should be remembered that this variety of apple is very easily bruised, and extra care should be taken when handling it. Pickers should be warned specially to refrain from the thumb and finger practice when taking hold of the fruit to remove it from the trees Finger marks (particularly thumb) become visible in a few hours after picking as slight almost circular bruised areas on the fruit, such bruises dry out after a while, but the appearance of the flesh of the fruit is irreparably marred by the presence of a brown patch under the skin The grading-machine is often blamed for this injury, when in reality the fault lies with the pickers Overfilling the picking-bags and carelessly emptying them will cause a similar injury to that of finger bruises

After-harvest Cleanliness.

As soon as possible after harvesting and packing operations for the season are over, the packing-shed should be thoroughly cleaned, and, if necessary, the grader repaired before storing during the off season All boxes broken beyond repair and rubbish generally should be destroyed by burning, while all waste fruit should be deeply buried. All remaining orchard boxes and props used for supporting heavily laden branches should be collected without delay. Those boxes which are sound should be dipped or sprayed in a strong lime-sulphur solution and stored in a dry position until again required, while those that need attention should first be repaired and then treated as just described.

Trees affected with silver leaf should be marked, otherwise they are easily overlooked once the foliage has disappeared In districts where fire-blight was known to exist during the past or previous summer a minute inspection should be made for cankers ; when located, each canker should be marked with a strip of white cloth, so as it can be removed by cutting well below the canker. The material removed should be destroyed by burning. Every canker removed is a source of infection eliminated.

Spraying of Stone-fruits.

For the better control of brown-rot, leaf curl, die-back, &c , stone-fruit trees should be examined carefully and all cankered and infested shoots, laterals, branches, and mummified fruits removed and destroyed by burning, for it is in such tree-parts that the fungous diseases overwinter by means of hibernating mycelium, as well as by conidia lodged in bud scales. It

is also recommended that trees which have made dense growth should be opened to the sunlight by removing all surplus growth ; this will enable the wood and buds for next year's crop to mature. When the above work has been completed the trees should receive an autumn dressing of bordeaux mixture, 5–4–50.

Drainage.

Adequate drainage is essential to the healthy growth of fruit-trees. It not only assists in sweetening the soil but raises its temperature. In addition it increases the depth of soil in which the roots of trees and other plants may feed The effects of an inadequately drained soil are reflected in the general unhealthy appearance of the trees, normal growth of which is impossible. Trees in a weakened condition readily become subject to fungous and physiological troubles Hence the importance of adequate drainage, whether pipe or otherwise, cannot be overstressed. The cleaning and deepening where necessary of the outlet drain should be the first consideration All lateral drains should then be tested, and, if found to be blocked or partially blocked, thoroughly cleaned so as to allow for the free flow of the drainage water.

In some orchards it may be deemed necessary to lay new drains to tap wet parts. If so, care must be exercised when digging the drain to make sure there is a sufficient fall the full length of the drain towards the outlet. When laying a drain in a retentive subsoil ready access for the surface water from the surface to the drain is imperative, therefore if pipes are used they should be covered with clean rubble or scrub A retentive subsoil placed in direct contact with the pipes will seal them during the wet season and thus prevent surface water reaching the drain. In dealing with underground water, such as springs or seepage, the pipes may be laid in the actual water, but at a sufficient depth to prevent the water rising to within at least 3 ft. from the surface.

New Plantations and Shelter.

Whether autumn or spring planting is contemplated the site should be thoroughly drained and the land cultivated during the previous summer and autumn. Fruit-trees must have adequate shelter, and, if possible, shelter-belts should be planted at least one year before the trees are set out.

In those districts where the soil is light and drainage good planting may be carried out during the month of May, provided, of course, the soil is not in a very dry condition or over wet Spring planting is recommended, as it allows several months longer for preparation of the land, including drainage, and the establishment of shelter-belts, &c. The order for trees should be placed with a reliable nurseryman as early as possible. It is wise to decide beforehand the purpose or class of trade for which the fruit will be grown and order accordingly. The distance apart for planting should be governed by the nature of the soil and the variety of the tree. On the better class of land stone-fruit should be planted about 20 ft. apart, cherries 25 ft. apart, and apples from 18 ft to 20 ft., or even 22 ft apart in the case of varieties which are tall and/or of a spreading habit. On arrival from the nursery the young trees should be unpacked and dipped in a solution of red-oil 1–10 as a safeguard against insect pests and their eggs. They should then be heeled in without delay. For this purpose it is advisable to dig a trench in a moist but well-drained soil and place the trees singly in it in a slanting position. The roots must then be adequately covered up with well-pulverized soil so as to prevent drying out. The trees will stand in such a position without detriment until required for planting.

—*J. W. Whelan, Orchard Instructor, Palmerston North.*

Citrus Culture.

There are several important factors which make for success in the planting of trees.

Adequate shelter should be well established some time beforehand, so that the growth of the young trees will not be in any way retarded. Without the necessary protection, care, and attention during the first two or three years they will not grow into satisfactory trees.

When selecting a site for planting, utilize land that is well drained and facing the sun. Land that is at all inclined to become water-logged is detrimental to the growth of citrus trees. If the land is not naturally drained steps should be taken to drain it before planting.

The soil should be cultivated thoroughly some time before it is intended to plant the trees. The more time and labour spent in this way the better the results obtained If the land is at all heavy a good dressing of lime applied immediately after ploughing will assist materially in the subsequent cultivation.

In the selection of trees, poor and stunted ones should be discarded, as only the best may be expected to give good results. Most nurserymen are now working from buds selected from outstanding trees, and as limited stocks only are being worked it is very necessary that trees for intended plantings should be ordered early, so that suitable trees may be obtained

Planting may be undertaken either in the autumn or spring, but preferably in the spring, as spring planting leaves more time for the land to sweeten and for any further cultivation that may be necessary.

In established groves only shallow ploughing should be carried out, owing to the surface-rooting habit of citrus trees Excessive cutting of the roots is detrimental to the growing tree.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

The Care of the Moulting Hens and the Growing Pullets.

By this time all birds intended for the breeding-pen should have been selected and the moult started if the best results are to be obtained. It is a mistake to leave the selection of the breeding-hens too late, as these external signs which indicate type, production, and, in many cases, constitution, disappear to some extent once a bird ceases laying and begins to moult, and it is only the very experienced poultryman who can successfully select breeding-stock when birds are moulting In some cases it will be found that a few of the best birds, especially those good two-and-a-half-year-old hens, will continue to lay after this time, and these should be separated from the rest of the flock and put on a light ration of grain for two or three weeks until they cease laying and start to moult.

The object should be to treat the breeders in such a way that they will be in the best condition to produce, early in the season, eggs containing the maximum fertility and vitality, and such results can be expected only when the breeders are allowed sufficient time to build up their energy after a heavy laying-season. It is, therefore, a great mistake to try to get the last egg from the birds in the autumn and expect them to be in a condition to give of their best in the early spring as breeders.

It is well, after the breeders have been selected, to examine them for insects, and if any are found all birds should be treated. If a large number have to be treated, the best method is the application of a small quantity of

nicotine sulphate along the perches just before the birds go to roost. If only a small number have to be treated, the dusting of fine powder into the feathers will rid them of body-lice. A good dusting-mixture can be made up of equal parts of lime, fine dry earth, and sulphur. In addition to treating the birds for external parasites, it is a good idea to give them suitable treatment internally. This may be done by first starving the birds for twenty-four hours, then feeding them a mash made up of equal parts of bran and pollard in which has been mixed a teaspoonful of Epsom salts to each three birds, and one teaspoonful of spirits of turpentine to every five birds. The spirits of turpentine should first be mixed with the bran. The amount of Epsom salts required should be dissolved in hot water and when thoroughly dissolved and the water cold it may be used to moisten the bran and pollard. It is well to mention that better results will be obtained when this mixture is fed cold.

The birds should be well fed during the moulting period, but care must be taken to see that they do not put on too much condition. It is well, therefore, to handle some of the birds from time to time, and if they show signs of getting overfat the amount of grain being fed should be slightly reduced and the mash ration increased slightly. It is advisable to make the birds work for their grain by feeding it in deep litter. This will induce exercise, which is an essential for conditioning stock for breeding purposes. Too much forcing food, such as meat, meat-meal, or milk, should not be given Good results have been obtained by feeding three times a week a mash consisting of two parts of pollard and one part of bran (by measure) with 5 per cent. meat-meal added. If skim-milk is used for mixing it will not be necessary to add meat-meal As much of this mash may be given as the birds will consume in about twenty minutes. The grain ration, which is given night and morning (except, of course, when the mash is fed), should consist of equal parts (by measure) of wheat, oats, and broken maize. Maize is, no doubt, rather expensive in the South, but the extra cost is worth while when it comes to the production of good hatchable eggs.

A regular supply of good succulent green-stuff is a very important item for all poultry, but especially so for breeding-stock In fact, good results could not be expected if the birds were kept short of this their natural tonic.

Though good results have been obtained for the past several years from breeding White Leghorns that are kept on the intensive system, poultry-keepers are advised strongly to give the breeding-birds a range on fresh, clean ground if at all possible.

All pullets should by now be settled in their winter quarters. On many occasions inquiries are made about the cause of early hatched birds going into a moult about this time. Experience has shown that pullets hatched before the middle of August will, if well reared, start laying in January or February and after laying for a few weeks the majority will go into a moult. This will happen under the best of management, and it seems almost impossible to prevent. However, if all the pullets cease laying about the same time, or if a number of the later-hatched birds go into a moult, it is generally a case of mismanagement somewhere. Any sudden change, either of quarters or feed, at this season of the year is likely to cause trouble with laying-pullets. A sudden change of feed such as from old to new season's grain will often cause laying-pullets to cease production and go into a moult. If a poultry-keeper finds he is running out of old season's grain and has to start on new grain it is well to begin by mixing one-quarter of the new with three-quarters of the old, then half and half, and so on, until by the end of ten days' time all new grain is being fed.

After some years of visiting many poultry-plants it has been concluded that overcrowding and underfeeding are amongst the chief causes of many pullets going into a false moult.

Many people are to-day keeping White Leghorns under the intensive system, and, under many local conditions, I am in favour of keeping Leghorn pullets closed up during the autumn and winter months, but they must be given plenty of room to live in. The best results noted under the intensive system were obtained where each bird was allowed 5 square feet of floor space. It would pay the poultry-keeper much better to cull his pullets heavily than to try and keep more birds than he has sufficient room for. No doubt the future egg-production of one's birds is influenced to a great extent by the way in which the young stock is reared.

It is a great mistake to force pullets to early maturity by feeding too much forcing-food such as meat, meat-meal, or milk ; at the same time it is a mistake not to give some animal food to growing stock, or to cut off the supply suddenly. More than one case of cannibalism has come under the writer's notice recently where the cause of this trouble was traced to the poultry-keeper having suddenly removed all animal food from the ration as he thought his pullets were coming on to lay too soon, for shortly after the meat-meal had been replaced in the ration the cannibalism ceased.

If at all practicable, it is a good plan constantly to grade the young stock and place those of similar age and size together. As the pullets begin to lay, the quantity and quality of their ration should be gradually increased. It is well to keep a close watch on the laying-pullets and try to keep their weight up, and if it is found that they are losing weight their grain ration should be slightly increased.

On some plants there is not sufficient trough space supplied, with the result that only the strongest pullets, and those with plenty of confidence, get sufficient feed, while the shy and nervous birds have to go short It is a good plan to allow at least 3 in trough space for each bird A regular supply of green feed for the pullets is very necessary, but it is well to remember that the green-feed supply can be excessive during the cold winter months.

A fixed quantity of feed is not advocated It is advisable to feed as much as the birds will consume greedily, and as soon as they begin to pick the food over, as if they did not care, or seem to be thinking of something else, then they have had sufficient, and a little less may be given next time

The following is a useful guide for any one wishing to know if his pullets are producing satisfactorily, as it is the average daily production, expressed as percentages, of 336 pullets at the Papanui laying competition during twelve months : April 22 per cent., May 51 per cent , June 53 per cent , July 55 per cent., August 65 per cent., September 74 per cent , October 75 per cent., November 68 per cent., December 64 per cent., January 56 per cent., February 53 per cent., March 32 per cent.

It should be remembered that when these birds entered the test they were all of practically equal age and were amongst the pick of each man's flock.

—*C. J. Cussen, Poultry Instructor, Christchurch.*

THE APIARY.

Management of Supers.

As advised previously the removal of the supers should go on steadily while the bees form their winter clusters. In the case of very strong colonies it will often be found difficult, if not impossible, to confine the bees to one story without seriously diminishing winter stores and unduly crowding the bees. In these cases it is best to leave the supers on till the spring.

The best place for winter stores is in the hive, and, however careful the beekeeper may be in replenishing these, if the honey is removed from the hives

he still runs the risk of allowing the bees to starve if the honey is not within their reach at all times during the cold weather. There are very few districts in New Zealand where brood-rearing absolutely ceases during the winter, especially when the hives are well sheltered, as the bees require food at all times and seasons. On no account should they be allowed to winter in more than two stories. In many cases they will be showing a tendency just now to go as high as they can get in the hives, and where this happens it will usually be found that the combs in the bottom story are deserted and dry. A rapid examination will soon show the beekeeper whether this state of affairs obtains, and, if so, he should remove the bottom story, leaving the cluster undisturbed.

Where queen-excluders have been left on the hives they should be removed, because it sometimes happens that the bees will go through the excluders to the stores above, leaving the queen to perish below. There is always a tendency for the cluster to move to the warmer part of the hive, and an excluder will not act as a bar if the bees are dissatisfied with the lower story.

Mats for Wintering.

To ensure that the bees are kept warm through the cold weather it is absolutely necessary that the frames should be well covered with good mats. Three or four are by no means too many to provide for each hive. Ordinary corn-sacks cut into pieces the size of a zinc queen-excluder answer the purpose admirably, and are very durable Avoid using calico mats, as these are next to useless for wintering purposes. It is essential that the mats should fit exactly over the frames ; if too small they admit draughts, and if too large the edges will protrude beyond the hive-covers, and in wet weather these will absorb sufficient water to cause the mats to become damp and unhealthy and the combs mouldy.

Clearing Weeds.

Weeds should be kept down in the apiary. A good clearing round the hives in autumn will suffice until spring, and will add materially to the comfort of the bees and the well-being of the hives during the winter months. Not only should the entrances be cleared, but the ground all round the hives should be similarly treated, and the weeds raked up and destroyed.

Uniting Colonies.

The presence of weak hives in the apiary must be avoided as far as possible. During the warm autumn days these colonies rarely escape the attention of robber-bees, and are easily molested. When once they are attacked the beekeeper will find it extremely difficult to save them, and eventually they will get robbed despite his efforts. It is by far the better plan to unite them with a stronger colony than to run the risk of unsettling the bees in the dormant season through the encouragement of wholesale robbing.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Planting Season.

A CERTAIN amount of planting is done at all seasons of the year, but the removal and replanting of trees and shrubs is practically confined to a period extending from about May to September inclusive, and is known as the planting-season. The object of planting is usually to provide timber for various purposes : shelter for crops, stock, and the homestead ; shade for stock and other purposes ; crops of fruit and nuts for sale or home use.

These are but a few of the practical results achieved when advantage is taken of the planting-season. The value of the achievements naturally depends on how the work is done, and, speaking generally, we have not made the improvement on the work of the early settlers that might have been expected. The result is best where a good deal of thought has been given to the selection of the trees and to their position and arrangement on the ground. Each locality has its own particular soil and climate. The greatest care is needed to select trees and shrubs that are quite suited to it, as well as the purpose in view. The arrangement and extent of the planting demand the same consideration These important decisions are best arrived at after studying the results of previous planting in the locality and getting the advice of a local authority.

For fruiting trees, and hybrids that are expected to crop heavily, the very best preparation of the land is required—that is, deep cultivation, the elimination of all bad weeds, and such generous treatment with organic manures as may be necessary. In other cases satisfactory preparation will consist of ploughing and cultivation to clean the land and retain moisture to assist in the establishment of the crop In such instances it is best to continue the cultivation periodically until the plants are thoroughly established. On steep or rocky country such preparation is not possible, and one has to limit the selection to plants which will succeed when given less attention, merely skimming a few square feet of land, breaking up with a spade the soil that is exposed, and setting the plant firmly in the centre. As grazing cannot be permitted after planting on such areas, owing to damage that may be done to the trees, the grass should be mown and allowed to lie as a mulch to enrich the land and retain moisture This is usually necessary but once a year, during the month of December.

Planting Small and Sundry Fruits.

In the warmer districts strawberry-planting is still being done, but should be concluded as soon as possible. This subject was dealt with in some detail in the January number

Bush fruits are planted among tree fruits to only a very limited extent in this country, and it can rarely be recommended. It may be done with advantage sometimes when establishing the home orchard, and so make a return while the trees are getting established. When deciding on the kinds for planting it is necessary to consider the demand for the crop, both for home use and commercial purposes, then comes the consideration of the suitability of the climate, soil and its preparation Gooseberries, currants, and raspberries thrive best in the cooler districts, an open situation and rather light land suiting gooseberries and red currants, whilst black currants and raspberries require a good loam where moisture is always present as well as good shelter from prevailing winds. To be carefully avoided is the planting of these bushes in the vegetable garden, even on its verge, as their interests clash The deep cultivation required for vegetable crops is injurious to the fibrous roots of the bushes, and the shade and competition of the bushes is detrimental to the vegetable crops. These berry crops are generally best planted in a block in a section of the home garden specially reserved for perennial crops, such as asparagus, rhubarb, and herbs, as the association has very much in common and there is little chance of their doing one another an injury. Commercial crops are set in a well-hedged paddock with probably high shelter on the weather boundary. The distance between rows and plants will vary with the quality of the land and the variety being planted, but for gooseberries and currants it should not be less than 5 ft. For black currants and raspberries it is generally advisable to plant the rows 6 ft. apart and 3 ft. between plants, the raspberries being planted in groups of three canes. A very good alternative method of planting raspberries is to set the canes singly 1 ft. apart in the row.

In the warmer localities most of the following fruits may be grown on suitable land: The Cape gooseberry (*Physalis peruviana*) is a herbaceous plant cut down by frost in winter, but shooting again from the crown in spring. Good forward plants set out 3 ft apart and 6 ft. between rows, in a light, rich, warm soil, during the early part of November, should crop well during the autumn for two or three seasons. The tree-tomato (*Cyphomandra betacea*) is enjoying an increasing popularity. This half-woody plant with large soft leaves grows here usually to a height of about 6 ft. It should be planted about 3 ft. apart in a fertile soil with ample shelter. The crop ripens in winter when not many kinds of fruit are available. The guava and also the feijoa are fruiting-shrubs from the warmer parts of South America Planted as informal hedges in the less exposed positions they should crop satisfactorily if the soil is good and care has been taken in the choice of varieties. Seedling plants may be bought cheaply, but they are rarely so good as selected varieties grown from cuttings, &c

The Chinese gooseberry (*Actinidia chinensis*), the passion-vine (*Passiflora edulis*), the loganberry, and the grape-vine are all vines requiring support—it usually takes the form of a post and wire fence about 4 ft. to 5 ft. high, but a wall with strained wires at intervals or a pergola is very suitable for the purpose in the home garden As the Actinidia is commonly diœcious, that is, it has staminate and pistillate flowers on different plants, both kinds must be planted to produce fruit In a rich, moist soil the fruit is produced fairly abundantly, and ripens in winter.

Fruiting-trees of moderate to fair height and suited to a mild climate are the loquat (*Eriobotrya japonica*), the avocado (*Persea gratissima*), the olive, the fig, and the pomegranate The first three are evergreens and the remainder deciduous, but they are alike in requiring a light, deep soil. A number of unsatisfactory trees of the kinds above mentioned are growing in many parts of the country In a few instances it may be that the soil or climate is unsuitable, but, generally, it is due to the fact that the trees are seedlings and comparatively worthless under any conditions, or the variety is not suited to the locality Planting as a rule should not be done unless the variety has proved itself suitable to the locality or one very similar. The avocado is indigenous to Mexico and Central and South America, but is now distributed in most tropical and subtropical countries. Those varieties likely to do best here are those derived from varieties growing in Mexico, where, growing for centuries at an altitude of from 6,000 ft. to 7,000 ft., they easily withstand fairly sharp winter frosts The introduction of some of the trees mentioned has not been carried sufficiently far to warrant commercial planting at present, but selected varieties are certainly worth a place in the home garden, as their beauty and utility are considerable.

The Tomato Crop under Glass.

For this crop the seed is sown during the month of May or early June. In the light of past experience the chief precautions are to see that sound seed of a suitable variety and good strain is used, and the seed-boxes when sown are kept at a temperature of about 60° F. More than 5° F. above or below that temperature is decidedly detrimental This means considerable supervision, which must be provided, or, debilitated by unsuitable conditions, the plants will fall an easy prey to pests and diseases of which there are usually far too many ready for such an opportunity. After watering the seed in, covering with glass and shading with paper, more water will not be required probably until the seedlings are pricked off. In any case water should be used sparingly and should always be tepid. In this way the plants are grown steadily and have a sturdiness that is the very best preventive for disease.

Where the glasshouse and soil in which the crop is to be grown have been thoroughly cleansed, as described in the January number, the green crop that may be sown should be trenched in as soon as it comes into flower, which is the indication that the growth is completed Only rarely does one find that in doing this the soil from below has been placed on top. This should be avoided, as the result is likely to be disastrous. Where a green crop is not available, and the land requires the addition of humus, well-fermented stable or farm manure should be spread and dug in after trenching These operations should be done without delay and not left until one is nearly ready to plant

Vegetable Crops.

Plantations of such perennial crops as asparagus, rhubarb, and sea-kale should now be cleaned up and given a dressing of fermented farm manure where humus is lacking Where new plantings are to be made a light, rich, moist soil is most suitable It should now be double-ploughed or trenched, and a generous application of manure turned in deeply in readiness for planting later

During the month of May it is found profitable in many districts to sow peas of an early variety and also broad beans. In frost-free localities early potatoes are also sown , as these are for early digging they may be sown rather closely with advantage

Stored produce will require close attention for another month, especially as regards ventilation

The Homestead Garden.

The time is now arriving when plans for the planting-season may be put into operation By trenching round a tree or shrub and undermining it until it is free, then rocking it carefully while refilling the hole, a large plant with roots practically entire may be brought to the surface, laid on its side, and rolled on to a sledge for removal By keeping the roots covered with wet sacks until it is safely replanted, the operation can be carried out successfully with comparatively few losses In this way a few readjustments in the planting-arrangement may often be done now with great advantage After resetting the plant it is well to reduce the top considerably so that transpiration may be adjusted to the capacity of the diminished root, and to see that the plant does not suffer from want of water. Unsuitable trees too large for removal should be chopped out altogether.

It is advisable to take delivery of new plants from the nursery as soon as they are available. Where the planting-arrangement has been fully planned and the ground prepared the plants may be set out at once if the ground is friable and free from any stickiness Trim away neatly any broken or straggling roots, and plant firmly to the same depth as previously Shorten the tops moderately to reduce wind resistance ; carefully considered pruning treatment can be given later Conifers and a few kinds of evergreens are exceptions to this pruning rule.

When planting has to be deferred the plants should be carefully unpacked, checked over, and heeled in. This is done by opening a trench in friable soil, standing the trees closely in the trench, and filling in the fine soil amongst them in order to cover the roots well Exposure of the roots should be avoided as much as possible, and roots should not be allowed to become dry.

New lawns should be trimmed as soon as the grass is long enough for cutting. It is advisable to use a mower that is in good order and set to cut high—generally as high as possible. The lawn should be cut when the grass is dry and afterwards rolled with a light roller. Those who are not so forward with the work should continue the preparation, and if it is completed too late for autumn sowing it may be done in spring-time.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: MARCH, 1934.

Dominion Meteorological Office.

NOTES FOR MARCH.

IN much the greater part of the North Island March was very dry. In the South Island conditions were more varied, and a most important feature was the breaking of the drought in Nelson and Marlborough by the heavy rains of the 27th. Temperatures were considerably below normal, but this was not altogether an unfavourable circumstance, since in combination with a general absence of strong winds it tended to mitigate the effects of the lack of rainfall, especially in the middle of the month.

Rainfall.—The only considerable area of the North Island which had more than the average rainfall included most of western Wellington south of Wanganui and extended to the northern Wairarapa. Over the rest of the Island the totals averaged only about half the normal, and the central and north-eastern districts recorded a particularly dry month. In the South Island an area in North Canterbury and south Marlborough had double the usual fall for March. Westport also had a heavy fall. Elsewhere conditions varied considerably, but excesses were rather less numerous than deficits.

Temperatures.—The month was a distinctly cold one. At most places the mean temperature was between 1 degree and 2 degrees below normal. A few frosts were recorded.

Sunshine.—In eastern districts of the South Island from Canterbury southwards cloudy and humid conditions prevailed, and sunshine was much below normal. Elsewhere totals were generally either equal to or better than average.

Pressure Systems.—A marked characteristic of the general situation was the disturbed conditions which prevailed in the tropics. Damage was done by cyclones in Australia on both the north-west and the Queensland coasts, while several less violent storms occurred in the area to the east of Australia. Associated with these conditions were a number of intense and widespreading anticyclones which occurred in New Zealand latitudes. In several the pressure at the centre exceeded 30·5 in., and the mean pressure for the month was considerably above normal.

On the 1st a shallow cyclone was located west of the Auckland Peninsula. This crossed the Peninsula during the night and was followed closely by a depression which had a cyclonic centre in its southern portion where it passed over Otago. Almost general rains resulted, with thunderstorms in places.

A westerly depression passing quickly between the 5th and the 7th was responsible for some very stormy weather. Thunderstorms were widespread on the night of the 7th, and in Canterbury there were some severe hailstorms. Snow fell on the ranges, the falls on Mount Egmont and at the National Park being unusually heavy.

Another rapidly moving westerly depression was responsible for some heavy rains in western districts of the South Island on the 12th.

The most important storm was cyclonic in form and moved slowly through Cook Strait between the 26th and 28th. General rains were recorded with many heavy falls, especially in the central portions of the Dominion. Falls of between 1 in. and 2 in. were recorded in the areas of Nelson and Marlborough, where drought had previously prevailed. Particularly heavy falls occurred in parts of North Canterbury and the Kaikoura districts, where rivers and creeks were in high flood. This rain and that of the 2nd were the only general rains.

Rainfalls for March, 1934, at Representative Stations.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.	Total for Year to Date.	Average for Year to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	1·94	7	1·70	3·10	7·47	10·54
Russell	3·46	7	2·80	3·28	8·59	9·52
Whangarei	2·94	11	1·96	4·45	9·77	12·25
Auckland	1·67	9	0·84	3·02	11·41	8·86
Hamilton	1·36	7	0·60	3·76	7·43	10·24
Rotorua	0·84	9	0·48	3·49	11·24	11·44
Kawhia	2·34	7	0·96	4·21	12·19	9·83
New Plymouth ..	2·42	10	0·90	3·72	10·36	11·70
Riversdale, Inglewood ..	5·80	11	1·72	7·04	13·82	20·58
Whangamomona ..	..	..	..	4·98	..	14·45
Hawera	2·43	8	0·90	3·01	9·80	8·92
Tairua	2·85	5	1·98	5·21	10·43	13·55
Tauranga	1·51	11	0·62	3·98	11·96	11·57
Maraehako Station, Opotiki	1·20	10	0·56	3·96	9·37	11·69
Gisborne	0·60	11	0·14	4·42	7·77	10·60
Taupo	0·89	6	0·46	3·14	11·29	9·25
Napier	0·96	8	0·32	3·13	10·86	8·84
Hastings	1·09	7	0·36	2·76	8·94	6·94
Whakarara Station ..	1·20	10	0·36	..	16·31	..
Taihape	1·46	8	0·61	2·61	9·06	8·00
Masterton	..	..	..	2·81	..	8·14
Patea	2·44	9	0·72	3·35	11·19	9·34
Wanganui	2·22	7	0·66	2·47	11·68	7·72
Foxton	3·43	6	1·88	1·98	8·36	6·19
Wellington	2·44	12	1·30	3·11	7·98	8·59
South Island.						
Westport	14·10	15	3·32	7·50	25·45	21·05
Greymouth	..	..	..	8·80	..	24·18
Hokitika	6·16	13	1·30	9·64	17·96	26·90
Ross	8·30	14	1·33	10·73	25·18	32·03
Arthur's Pass ..	11·38	10	2·90	13·19	29·07	37·21
Okuru, South Westland	..	..	..	14·15	..	36·40
Collingwood	5·53	11	3·25	5·81	11·94	17·68
Nelson	3·15	8	1·52	2·91	6·26	8·35
Spring Creek, Blenheim	1·73	5	1·22	1·98	3·47	6·38
Hanmer Springs ..	7·16	10	3·86	3·20	18·87	10·30
Highfield, Waiau ..	6·10	6	4·12	2·84	12·97	8·42
Gore Bay	..	..	..	2·13	..	7·39
Christchurch	1·78	10	0·44	1·98	6·75	5·90
Timaru	2·15	11	0·68	2·20	10·79	6·31
Lambrook Station, Fairlie	2·21	9	0·59	2·34	9·07	6·58
Benmore Station, Clearburn	2·34	10	0·63	2·41	6·02	6·80
Oamaru	1·29	13	0·58	1·78	7·17	5·61
Queenstown	3·37	12	0·98	2·61	6·51	7·47
Clyde	1·75	9	0·53	1·49	5·61	4·40
Dunedin	2·50	18	0·56	2·94	10·32	9·10
Wendon	3·51	13	0·70	2·74	7·96	8·20
Gore	..	..	..	3·25	..	8·98
Invercargill	4·57	20	0·94	3·87	10·36	11·00
Puysegur Point ..	7·90	23	2·07	7·97	16·86	21·33
Half-moon Bay ..	3·55	19	0·53	5·37	10·53	14·27

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

RUPTURE IN PIGS.

F. L. S., Studholme Junction :—

I have a litter of pigs three weeks old, of which two of the male pigs appear to be ruptured. Can I castrate in usual manner or will bowel of pig come out? I would appreciate any information you can give me regarding this matter. If incurable, could I keep them until big enough to kill for own use - say, 40 lb. weight? May this trouble be the fault of a parent, as in this case I suspect the boar?

The Live-stock Division :—

The castration of a ruptured animal by the usual method is generally followed by a prolapse of the bowel and cannot be recommended. A special operation known as the "covered" operation should be performed if castration is decided upon. There is no reason why you should not keep the pigs for your own use, but it is advisable to fatten them as quickly as you possibly can, thus avoiding a possibility of what is known as "boar taint" Congenital predisposition is generally considered to be the cause of rupture in young pigs

FEEDING BARLEY TO POULTRY.

G. H. M., Seddon :—

In regard to the Wallaceville barley-feeding trial for experimental purposes, would you be good enough to inform me what variety of barley was used, and if hulled or not? Can you say if barley-meal could be used with advantage in a ration for laying-ducks, and, if so, what should be the composition of such a ration?

The Live-stock Division :—

Whole (not hulled) barley of a the chevalier variety was used In the feeding trials the barley-fed birds were fed the following wet mash ration . Barley-meal, 32 lb ; pollard, 14 lb ; bran, 18 lb ; meat-meal, 7 lb (approximately 10 per cent.) If barley-meal 2 parts and bran 1 part were used to form a mash for feeding to ducks it probably would be advisable to increase the amount of meat content from 10 per cent to say 12 per cent, according to the production of the birds, and also to see that ample green feed was supplied The question of whether barley-meal could be fed to advantage instead of the ordinary ration of pollard and bran depends on the prices of barley-meal and pollard

APHIS ON CABBAGE FAMILY.

R. H. S., Lumsden :—

In my vegetable garden, the cabbage family, notably Brussels sprouts, are troubled with an insect which gathers in colonies on the leaves—a small roundish and soft blue-green blight which makes the leaves curl. Can this be controlled in some economical way?

The Horticulture Division :—

From the description given there is little doubt the are colonies of aphides which infest the cabbage-plants. Where only a few plants are concerned spraying with a strong soap solution weekly is a good method of keeping young plants free from this pest Large crops may be treated by placing a pinch of tobacco powder in the heart of the plant or dusting plants with tobacco powder, as may be necessary. If the treatment is commenced early it will prevent the establishment of the colonies.

The New Zealand

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THE OAT VARIETIES OF NEW ZEALAND.

J. W. HADFIELD and R. A CALDER, Plant Research Station, Palmerston North.

DESPITE a reduction in the farm consumption of oats and oaten chaff following an increase in power farming, the oat still remains one of the three important arable crops of New Zealand. Its acreage is exceeded only by that of turnips, and its value equals, if it does not slightly exceed, that of wheat. Table 1 shows the position of the oat crop relative to that of wheat.

Table I — Values and Acreages of Wheat and of Oats in New Zealand

(Compiled from statistics issued by the Census and Statistics Office)

VALUE IN MILLIONS OF POUNDS

—	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31	1931–32.	1932–33
Wheat ..	1·18	1·80	1·56	2·46	3·04	2·71	2·29	2·23	1·62	2·42
Oats ..	3·22	4·21	3·07	3·12	2·50	2·39	2·86	2·19	2·08	2·13

AREA IN THOUSANDS OF ACRES.

—	1923–24.	1924–25.	1925–26.	1926–27	1927–28	1928–29.	1929–30.	1930–31.	1931–32.	1932–33
Wheat ..	179	169	153	222	203	258	230	252	281	306
Oats ..	417	472	367	387	304	283	283	368	364	425

The importance of the crop is sufficient justification for this attempt to place on record the descriptions, distribution, utilization, and agronomic features of the more important varieties.

Much of the information offered has been collated from estimates submitted by Fields Superintendents and their staffs from every section of the country. Full acknowledgment is accorded them for their helpful co-operation. The type descriptions are the result of observations over two seasons by one of the authors (R. A. C.).

In 1932, through the courtesy of seed-merchants, a collection was made of about two hundred samples of seed oats from districts in which they had been harvested. These samples were grown primarily with the object of affording material from which varietal descriptions might be prepared, but they served also in revealing the general standard of the seed oats being offered in this country in respect to varietal purity and smut infection.

VARIETAL PURITY AND SMUT INFECTION.

Observations made on these trials revealed the position recorded in Table 2.

Table 2.—Incidence of Varietal Impurities and Smut in Commercial Samples of Seed Oats from the 1931–32 Harvest

(Trials conducted during the 1932–33 season.)

Variety.	Percentage of Impurities.	Percentage of Smutted Plants.
"Gartons"*	4·3	3·3
Algerian	0·4	1·2
Dun	0·5	3·4
Sparrowbill	12·5	0·4
Other varieties	4·3	5·4

* The use of the term "Gartons" is explained under the heading "Gartons Abundance."

It will be observed that the two varieties Algerian and Dun, which are commonly sown in the autumn, and are able to withstand heavy grazing during the autumn and winter, contain the lowest percentage of impurities. Algerian shows also a relatively low degree of smut infection, which fact lends credence to an impression held by many farmers that Algerian is less susceptible to this disease than are other commonly grown varieties.

The position is, however, far from satisfactory and calls for immediate steps in raising and distributing pure and smut-free seed. "Gartons"* alone represent 42 per cent. of the total acreage in oats, virtually the whole of which is harvested either for grain or chaff. A wastage of 4·3 per cent. due to smut on 42 per cent. of the oat crop valued at £2,000,000 is equivalent to an annual loss of £36,000.

DISTRIBUTION OF VARIETIES.

Rust is the most important factor governing the distribution of varieties. In the North Island Algerian, being rust-resistant, comprises 83 per cent. of the oats grown, and over most of this area is the only variety in general use that may be grown to maturity with any degree of success. It is preferred, even when grown primarily for green feed, on account of the possibility that circumstances may render it desirable to save the crop for chaff. On the other hand, in the cooler parts of Otago and Southland rust is not a serious consideration and "Gartons"* represent over 80 per cent. of the crop while Algerian is very rarely grown.

The variety of purposes for which the oat crop is used such as milling, feed oats, chaff, hay, ensilage and green feed, and the different soil and climatic conditions under which it is grown, might lead one to expect that a wide range of varieties, such as is available in other temperate climates, would be required to serve all purposes in this country. The varieties in use are, however, very limited, and their approximate distribution over New Zealand is shown in Table 3. The North and the South Island figures are given separately and the South Island is further divided on the basis of the two important and distinctive climates obtaining there.

Table 3.—Distribution of Oat Varieties in New Zealand, 1932–33.

District.	Acreage.	Percentage of Total Acreage represented by Varieties.			
		Algerian.	"Gartons."	Dun.	Other Varieties.
New Zealand	424,587	38	42	12	8
North Island	38,747	83	15·5	1·5	
South Island	385,840	33·4	45	13·2	8·4
Marlborough, Nelson, Canterbury, and North Otago	271,684	44	30·5	14·5	10
Mid and South Otago and Southland	102,804	0·3	80·6	12·6	6·5

It is not possible to say whether the varieties in general use are the most satisfactory from all points of view, since no systematic attempt has been made to determine the value in New Zealand of the many varieties available from other countries.

Utilization.

Returns compiled by the Census and Statistics Office divide the oat acreage into that harvested for grain, that for chaff, hay, or ensilage, and that not harvested but fed off as green feed. The information given in Table 4 is based on these returns.

Table 4.—Utilization of the Oat Crop in New Zealand, 1932–33.

District.	Total Area.	Threshed	Chaff, Hay, and Ensilage.	Fed off and not harvested.
	Acres	Per Cent.	Per Cent.	Per Cent.
New Zealand	424,587	27·4	61·1	11·5
North Island	38,747	9·3	71·3	19·4
South Island	385,840	29·2	60·0	10·8
Marlborough, Nelson, Canterbury, and North Otago	271,684	27·2	59·2	13·6
Mid and South Otago and Southland	102,804	36·2	59·9	3·9

In considering Table 4, it must be appreciated that, apart from the area used only for green feed, a very large proportion of the balance is autumn sown and grazed during the autumn and winter months. This is especially true of Algerian, but information of a more specific nature is given later under each variety.

Varietal Descriptions.

An attempt has been made to adopt standardized descriptions. While these have been made as simple as possible, it would seem nevertheless desirable to offer some prefatory comments.

The plants which formed the basis of these observations were spaced 8 in. by 6 in. apart. Such a characteristic therefore as tillering, which is modified by opportunity for development, must be regarded as

relative rather than actual. Under normal seeding and management tillering, for example, would be reduced far below the figures given. The observations do, nevertheless, afford useful relative comparisons.

Pretillering Stage.—This refers to that period subsequent to germination and prior to the development of potential panicle-bearing shoots. At this stage the herbage may present distinct forms of growth—*e.g.*, erect, semi-erect, prostrate. These are definite varietal characteristics, and the prostrate habit is associated with winter hardiness. This is a matter of no great significance in this country, except that varieties of this habit are usually those best able to withstand winter grazing and yet be capable of producing a satisfactory crop the following harvest.

Post-tillering Stage.—Tiller-production is the normal mode of branching commonly met with in cereals. Tillers arise at the base of the plant near the ground, and although tillers are the ear-bearing shoots, only a certain proportion of them finally produce panicles; thus arise the terms "fertile" and "infertile" tillers. Tiller-production may be regarded as an important varietal character, those producing abundant tillers being tolerant to autumn and winter grazing.

Panicle Emergence and Maturity.—In the two seasons during which these observations were made the plots were sown in the middle of August. Time of sowing has a direct influence on the period that elapses between germination and maturity and, owing to bird damage, the only possible basis for comparisons was panicle emergence. This may be regarded as a fairly reliable guide, although not as accurate as might be desired.

Leaf Characteristics.—At the date of initial panicle emergence the largest leaves were measured for length and breadth and in these descriptions are described as narrow, medium, and broad. The presence of hairs around the base of the leaf, and sometimes extending a short distance along the margin, serves a useful distinguishing feature.

The Panicle.—The term refers to the whole inflorescence, which is composed of a main axis or rachis from which arise numerous branches. These branches bear the spikelets within which the flower, and later the mature seed, is enclosed. The rachis is subdivided by nodes from which the branches arise. It may be straight or bent at the nodes. The branches occur in whorls. Their length and habit form useful means of varietal identification. When they arise at an angle of 45° or more to the main axis the panicle is termed "open". When almost directly ascending and closely adpressed to the axis the panicle is said to be "compact" or "closed". The panicle is said to be "equilateral" when the branches are balanced on each side of the axis, when directed to one side it is then "one sided."

The spikelets carry generally two flowers within the outer glumes and therefore two grains. The number is, however, variable.

The Grain.—This consists of a kernel enclosed within a husk and usually forms the simplest and most definite means of identification. The husk is composed of two separate structures, the flowering glume or lemma, and the pale, both of which are closely attached to, and completely surround, the kernel. When the grain is fully ripe these components develop a characteristic colour which is one of the most commonly used points for varietal differentiation. Although these colours are characteristic, they are not always well defined, being subject to modification under the influence of climatic conditions. Extending the length of the lemma may be observed what are known as "nerves," which may or may not be prominent. The awn, if present, is attached midway along the dorsal surface of the lemma and is in reality an elongation of the midrib of the lemma. It is usually confined to the lower grain of the spikelet and in some of the more highly developed varieties is much reduced in size or even absent. The long coarse twisted awn is an outstanding peculiarity of the wild oat. During threshing and cleaning processes the awns are removed and are seldom apparent in a dressed sample. Basal hairs arise around the base of the grain and generally accompany an extensive awn development—*e.g.*, wild oat and Algerian. They may be few, numerous, or absent, and when present may be long, short, coarse, or fine. Rachilla is the small stalk by which the upper grain is attached to the lower, and its length, colour, and hairiness may be used for purposes of identification.

The Varieties.

Appended are descriptions of the main botanical and agronomic characteristics of the varieties specified.

(1) GARTON'S ABUNDANCE.

(The description given may also be applied to the sample sent in under the name "Newmarket.")

The Plant.—Pretillering stage: Erect. Tiller development, low (10–11); ultimate panicle production, intermediate (5–6). Panicle emergence: Mid-season (115–120 days). Leaves: Broad, dark green, practically no appearance of hairs round base. Straw: Coarse, rather tall.

Panicle.—Long, erect, equilateral, open. Rachis. Straight. Branches: Long at an angle of 30°–45° or less to rachis. Spikelet: Two-grained, lower grain awned.

Grain—Medium length, plump. Husk: Cream to white—nerves not prominent Awns. Long, coarse, dark in colour, and twisted at base. Basal hairs absent Rachilla: Medium length, fine, white, not hairy.

Garton's Abundance may be regarded as the standard white oat of New Zealand. So much so, in fact, that the name "Gartons" has become a trade term for all white oats, except those of distinctive character such as Sparrowbill. "Gartons A," and "Gartons B" are expressive of grades covering any ordinary white oat, and are quoted in that manner. The foundation of the "Gartons" trade oat is Garton's Abundance but includes also Record, Leader, Hero, and other varieties of secondary or very minor importance. There are now few pure crops of Record and Leader, although they appear as common impurities in Garton's Abundance. In these notes, therefore, the term "Gartons" is to be regarded as having reference primarily to Garton's Abundance, although other varieties are included.

"Gartons" probably represent 42 per cent. of the total acreage in oats in New Zealand made up in the North Island by 15·5 per cent., and in the South Island by 45 per cent. of their respective acreages. In the North, with the exception of a few hundred acres, the variety is confined to the Hawke's Bay and Wairarapa districts. In the South Island from North Otago northwards, probably 30·5 per cent. of the area is devoted to "Gartons" and southward 80·6 per cent. or more.

The use to which the variety is put may best be presented in tabular form as follows:—

Table 5.—Utilisation of "Gartons" Oat in New Zealand.

District.	Acreage.	Grain.	Chaff, Hay, &c.	Fed off and not harvested.
		Per Cent.	Per Cent.	Per Cent.
New Zealand	149,438	40	52	8
North Island	4,925	14	36	50
South Island	144,513	42	53	5
Marlborough, Nelson, Canterbury, and North Otago	66,513	45	48	7
Mid and South Otago and Southland	77,400	38	58	4

It is evident from Table 5 that "Gartons" are used almost exclusively for grain and chaff, the 50 per cent. recorded in the North Island as being used for green feed representing actually a very small acreage. They cannot be used as readily as Algerian for winter grazing and still ensure the same prospects of a succeeding crop. The yield of chaff generally exceeds that of Algerian, but the quality is not regarded as being as good, owing to its rather coarse and leafy nature. This is particularly true of "Gartons" on heavy land, and under such circumstances a coarse, tangled crop often results from autumn sowing. In addition to its value as a feed oat the grain is used extensively for milling in the manufacture of oatmeal and proprietary cereal foods, the centre of this industry being in Southland.

(2) ALGERIAN.

The Plant.—Pretillering stage: Prostrate. Tiller development: High (20–25). Ultimate panicle production: High (10–11). Panicle emergence: Early (95–100 days). Leaves: Rather narrow, medium green, base edges slightly hairy. Straw: fine, medium height.

Panicle.—Medium length, erect, equilateral, open. Rachis: Straight. Branches: Medium length, at an angle of 45° or greater, drooping at tip. Spikelet: Two-grained, both generally awned.

Grain.—Long, pointed, narrow. Husk: Light brown or dark yellow, nerves prominent. Awn: Long, fine, slightly twisted at base; that of the lower grain is more strongly developed than that of the upper one. Basal hairs: Prominent on lower grain; generally numerous, long, and rather coarse; not apparent in dressed samples. Rachilla: Medium length, fine, non-hairy; remains attached to upper grain.

Observations on the plots sown with samples of Algerian oats collected from merchants revealed the existence of distinct strains or types. A few of the commercial samples were relatively pure in respect to one or other of these strains, and their study is now being extended with progenies of single plant selections. In spring-sown plots at Palmerston North the differences were very marked during both seasons. While intermediate types did occur the extremes may be described as—

(1) Growth during pretillering stage relatively upright, mature plant tall, early and very productive.

(2) Pretillering growth prostrate, maturity late, plant very leafy, short, producing few heads and little grain.

When spring sown at Lincoln, Canterbury, these differences were scarcely observable, nor were they at all marked in autumn-sown plots at Palmerston North. It seems possible that further investigation will reveal the existence of winter and spring strains. The type description given above is on an intermediate type.

Australian Algerians have from time to time been sown in New Zealand and have given rise to queries owing to variations in time of maturity. In a communication Mr. Wenholz, Director of Plant Breeding in New South Wales, says, "The early strain of Algerians cannot be distinguished morphologically from the true strain; but, in addition to this, there are some crops in which the variety Belar and Algerian also appear to be mixed in some part of the State."

For many years the Canterbury Agricultural College has distributed an improved strain under the name of "College Algerian." In this selection particular attention was paid to its dual-purpose value,

affording satisfactory winter grazing in addition to grain and chaff. In the trial of commercial samples it was very evident that some of those marked "College" were misnamed, and others had been mixed since distribution had been effected by the College.

Rust-resistance is the most important feature which renders the Algerian oat of value in New Zealand. In the North and parts of the South Island where this disease is a limiting factor, virtually no other variety is grown. Even when grown for green feed Algerian is used in such districts, since there is always a possibility that the crop will be saved for chaff. Thus it comes about that 83 per cent. of the North Island acreage is in this variety, which includes the Wairarapa with 77 per cent. and Hawke's Bay with only 64 per cent.

Of the North Island acreage it is estimated that 23 per cent. is grazed only, 5 per cent. is harvested for grain, and the remaining 72 per cent. harvested for chaff, hay, or ensilage. When consideration is given to the fact that a fair proportion of the harvested crop is also grazed during winter, it is realized that the Algerian oat is of considerable importance as a supplementary forage crop.

In the South Island this variety represents about 43 per cent. of the Canterbury and North Otago crop. Further south than this it is rarely grown. In Canterbury and North Otago approximately one-third of the area is harvested for grain, one-third for chaff, and one-third for green feed only. Here, again, the bulk of the harvested crop affords supplementary feed during winter.

In Marlborough and Nelson probably 90 per cent. of the oat acreage is Algerian, of which 70 to 80 per cent. is cut for chaff and 15 to 20 per cent. cut for grain.

The ability of this variety to afford winter grazing and yet yield a satisfactory crop even under the most adverse conditions, coupled with its rust-resistance, are the two factors responsible for its popularity. The grain is used extensively as a feed oat, and the chaff is fine, sweet, and of good quality with very little leaf. In actual yield, however, it falls short of Garton's Abundance, more particularly when spring sown. Commercial lines of seed appear reasonably free from smut and are fairly pure, except for the occurrence of different strains about which little is known at present.

(3) DUN.

The Plant. Pretillering stage: Prostrate. Tiller development: Very high (30–32). Ultimate panicle production: Very high (16–17). Panicle emergence: Mid-season (118–120 days). Leaves: Narrow, medium to dark green; base edges hairy; lowest leaf-sheath hairy. Straw: Fine, medium height.

Panicle.—Medium length to long; open, erect, equilateral. Rachis: Straight. Branches: Long, inclined at an angle of 45° or greater. Spikelet: Two-grained, lower grain generally awned.

Grain.—Rather long and narrow. Husk: Light to dark grey, nerves sometimes prominent. Awns: Long, dark, and slightly twisted at base. Basal hairs: Few and rather fine. Rachilla: Medium length to long; fine.

Approximately 12 per cent. of the New Zealand acreage consists of this variety, which is confined almost exclusively to the South Island. It is susceptible to rust, and crops are grown mostly in the higher

country or cooler localities. One main feature is its popularity as a feed for racehorses, largely on account, it is claimed, of a high proportion of oil in the seed. For this reason a dark colour in the seed is desired. The chaff is fine and of the highest quality. A second feature is its high tiller development, permitting winter grazing under severe climatic conditions and ability to produce a satisfactory crop of chaff the following summer.

(4) GREEN'S RUAKURA.

The Plant.—Pretillering stage: Semi-erect to erect Tiller development: High (18–20). Ultimate panicle production: Very high (15–16). Panicle emergence: Early (90–95 days). Leaves: Narrow to medium width, edges and base hairy; lowest leaf-sheath hairy. Straw: Fine, medium height; nodes distinctly hairy above and below juncture.

Panicle.—Long, open, equilateral. Rachis: Straight. Branches: Long, at an angle of 45° or greater. Spikelet: Two to three grained, lower grain awned

Grain—Medium length, rather plump Husk: Straw coloured to dark dun, nerves prominent Awns. Long, coarse, twisted and dark at base. Basal hairs: Numerous, coarse, well developed. Rachilla. Short to medium length, rather stout; may be slightly hairy.

This variety is a selection from Argentina oat made in 1908 by Mr. A. W. Green, then at the Ruakura Farm of Instruction. The original head was one of over a thousand selections made from the varieties Algerian, Argentina, and Red Rust-proof with the specific object of attaining a high degree of rust-resistance. By 1914, 3,000 bushels of seed were available and sold at £1 per bushel. The name had until then been "Ruakura Rust-resistant," but owing to misunderstanding as to the difference between "rust-resistant" and "rust-proof," this was changed in 1914 to "Green's Ruakura." It proved to have far higher resistance to rust than Algerian and Red Rust-proof, and was for many years extremely popular in the North Island. Its distribution extended overseas, where its rust-resistance is well recognized and in certain places is still grown commercially. In New Zealand its use has virtually ceased. Mr. P. W. Smallfield, Fields Superintendent, at Auckland, reports that it was last grown at the Ruakura Farm in the 1923–24 season and that for a few years before that the yield was becoming progressively lower, so that a change-over was made to Algerian, and this variety has been grown ever since.

It is difficult to account for this deterioration. Apart from the fact that the straw is somewhat weak the Ruakura oat has grown remarkably well in plot trials at this Station and at the Pure Seed Station, Lincoln.

During the 1932–33 season the Canterbury (N.Z.) Seed Co., Ltd., grew on their property at Leeston, 14 acres of Ruakura oats. This was possibly the only area of this variety in New Zealand and had been raised by the firm from a handful of seed procured some years previously. Rust was extremely severe, so much so that Potato and Dun oats yielded only 27 bushels per acre, while the crop of 14 acres of Ruakura oats in the same paddock was not affected and yielded 114 bushels per acre.

Steps are now being taken to explore further the possibilities of the variety and to raise pure seed in the event of a demand forthcoming.

(5) SPARROWBILL.

The Plant.—Pretillering stage : Erect. Tiller development : Intermediate (14–15). Ultimate panicle production : Intermediate (6–7). Panicle emergence : Late (124–126 days). Leaves : Medium width, medium green to dark green in colour ; no hairs. Straw : Coarse, tall.

Panicle.—Long, equilateral, very compact. Rachis : Bent at and between nodes. Branches : Medium length, directly ascending and adpressed to rachis. Spikelet : One to two grained ; no awns.

Grain.—Short and plump. Husk : White to creamy yellow, nerves not prominent. Awns absent Basal hairs : Rare or absent. Rachilla : Medium length, fine, white, non-hairy.

The cultivation of this variety is confined almost exclusively to Mid and South Otago and parts of Southland. At one time it was

SPARROWBILL. HERO. SIR DOUGLAS HAIG. BLACK SUPREME. BLACK TARTAR.

grown fairly extensively, but now probably not more than 4,000 acres are sown, representing about 1 per cent. of the New Zealand acreage.

The grain is of value for milling and is also used as poultry-feed, and there is a small demand for seed of this variety for growing as green feed in the North Island.

(6) RECORD.

(The description may also be applied to sample sent in under name of White Winter.)

The Plant.—Pretillering stage : Erect. Tiller development : Very low (9–10). Ultimate panicle production : Very low (3–4). Panicle emergence : Mid-season (115–120 days). Leaves : Medium width, medium to dark green ; a few hairs round base of leaf. Straw : Coarse, rather tall.

Panicle.—Long, equilateral, compact. Rachis: Generally bent at nodes. Branches: Long, directly ascending and adpressed to rachis. Spikelet: One to two grained; only an occasional awn on lower grain.

Grain.—Rather long, plump. Husk: Light yellow, nerves not prominent. Awns: Long, dark, and slightly twisted at base. Basal hairs absent. Rachilla: Medium to long, fine; non-hairy.

A few crops of Record are still grown, but in the main it has been replaced by Garton's Abundance. The comments under the latter variety apply equally to Record, the seed of both being regarded in the trade as "Gartons." Record is included in the tables as "Gartons."

(7) Hero.

The Plant.—Pretillering stage: Erect. Tiller development: Low (11-12). Ultimate panicle production: Very low (3-4). Panicle emergence: Mid-season (115–120 days). Leaves: Medium width, dark green. No hairs. Straw: Coarse, rather tall.

Panicle.—Long, one-sided, compact. Rachis: Bent slightly at nodes. Branches: Long, directly ascending and closely adpressed to rachis. Spikelet: Two-grained with only an occasional awn on lower grain.

Grain.—Medium length, rather plump. Husk: White or light yellow, nerves not prominent. Awns: Long, dark, and twisted at base. Basal hairs absent. Rachilla: Medium length, medium thickness.

This variety is similar in many respects to Record and White Winter and is classed as a "Garton," and included in the tables under this heading. Pure crops are still grown, but in the main the variety is being replaced by Garton's Abundance.

(8) Sir Douglas Haig.

The Plant.—Pretillering stage: Erect. Tiller development: Very low (8-9). Ultimate panicle production: Very low (3–4). Panicle emergence: Mid-season (115–120 days). Leaves: Very broad, pronounced droop towards tip; a few hairs around base. Straw: Coarse, rather tall.

Panicle.—Long, one-sided, compact. Rachis: Bent slightly at lower nodes. Branches: Long, directly ascending and closely adpressed to rachis. Spikelet: Two, three, or four grained, an occasional awn on lowest grain.

Grain.—Rather long and narrow. Husk: Yellowish to dark brown, nerves prominent. Awns: Medium length, fine, pale, twisted slightly at base. Basal hairs may or may not be present. Hairs may generally be observed on the lemma immediately below and bordering the base of the awn. Rachilla: Long, fine, that attached to the lower grain being hairy. Rachilla of upper grains may be considerably elongated, projecting them beyond the tip of the spikelet.

A variety of distinct possibility, but so far is reported only in Marlborough where it is recognized as of value for green feed.

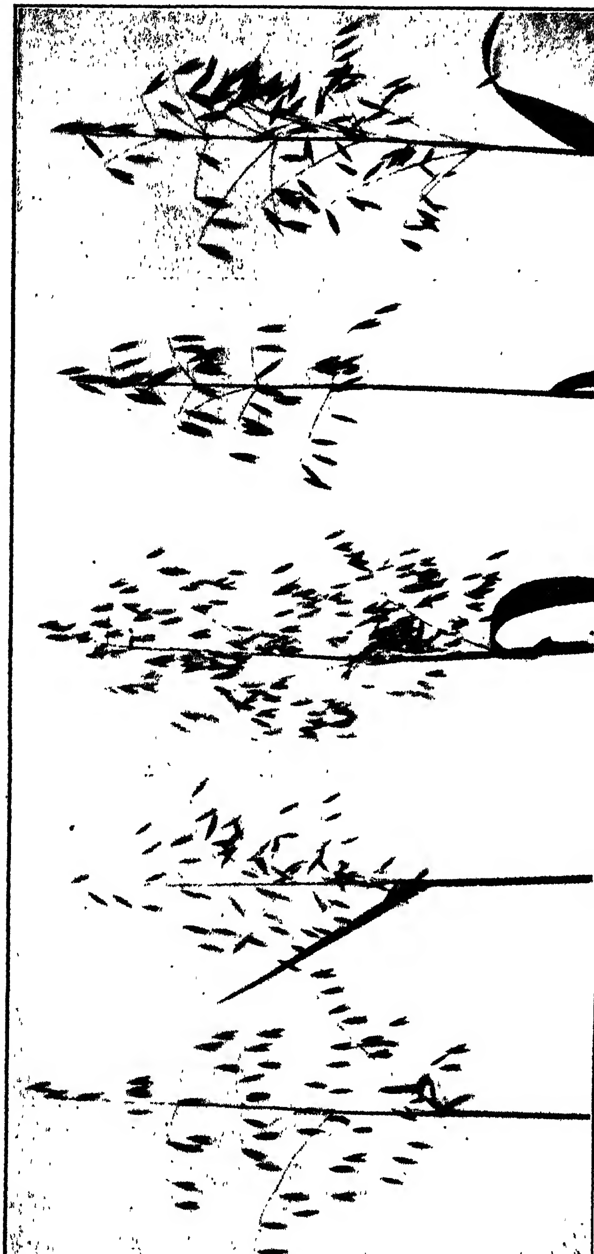
(9) Black Tartar.

The Plant.—Pretillering stage: Erect. Tiller development: Intermediate (12–14). Ultimate panicle production: Low (4–5). Panicle emergence: Late (120–125 days). Leaves: Medium width; medium to dark green. No hairs. Straw: Coarse, rather tall.

Panicle.—Medium length, one-sided, narrow, and compact. Rachis: Distinctly bent at and slightly curved between nodes. Branches: Medium length and closely adpressed to rachis. Spikelet: Two-grained, an occasional awn on lower grain.

Grain.—Rather long and plump. Husk: Black to dark brown, nerves not prominent. Awns: Short to medium length, fine, not twisted at base. Basal hairs: Not numerous, short and fine. Rachilla: Medium length to long, fine, light brown in colour.

Probably somewhere in the vicinity of 1,000 to 1,500 acres are grown annually in Otago and Southland, and is a variety particularly adapted for high country.



RUAKURA. ALGERIAN. ABUNDANCE. WEBB'S CHALLENGE. DUN.

(10) Webb's Challenge.

(The following description may also be applied to samples sent in under the names of "Black Prolific," "Black Scotch," and "Black Excelsior.")

The Plant.—Pretillering stage: Prostrate to semi-erect. Tiller development. Very high (30–31). Ultimate panicle production: High (10-11). Panicle emergence: Mid-season (118–120 days). Leaves: Narrow to medium width; medium to dark green with a greyish tinge; base and edge quite hairy; lowest leaf-sheath hairy. Straw: Fine, medium height.

Panicle.—Long, erect, equilateral, open. Rachis: Waved slightly at and between nodes. Branches: Long, at an angle of 45° or less Spikelet: Two-grained, lower grain generally awned.

ALGERIAN STRAINS.

On the left is a tall, early, and productive strain; in the centre an intermediate form; and on the right a late strain which is extremely unproductive when autumn-sown at this Station. The sheaves are the actual produce from adjoining plots of equal size.

Grain.—Long, rather plump. Husk: Dark mahogany to black in colour, nerves not prominent. Awn: Long, dark, and twisted at base. Basal hairs: Numerous and coarse. Hairs also may generally be observed on the lemma immediately below and bordering the base of the awn. Rachilla: Long, fine, hairy.

Distribution of this variety is mainly confined to Otago and Southland, and it is estimated to occupy from 1,000 to 1,500 acres annually.

(11) Black Supreme.

(The description may also be applied to the sample sent in as "Black Superior.")

The Plant.—Pretillering stage: Erect. Tiller development: Low (10–12). Ultimate panicle production: Very low (3–4). Panicle emergence: Mid-season (116–118 days). Leaves: Broad, medium to dark green; base and edges hairy; lowest leaf-sheath hairy. Straw: Coarse, rather tall.

Panicle.—Short to medium length, one-sided, dense, compact Rachis. Bent at nodes. Branches: Medium length, directly ascending and closely adpressed to rachis. Spikelet: Two-grained, lower grain occasionally awned.

Grain.—Short to medium length, plump. Husk: Black to dark brown, nerves not prominent. Awns: Medium length, dark, and slightly twisted at base Basal hairs absent. Rachilla: Medium length, rather stout.

FIELD TRIALS WITH "CERESAN NEW" SEED DUST.

J C. NEILL, Field Mycologist, Plant Research Station, Palmerston North.

DURING the 1933 34 season a series of eighty-one trials of the organic mercury seed dust "Ceresan New" was carried out on field crops of oats, barley, wheat, and peas in the chief cropping-areas of the Dominion. The trials were made possible by the co-operation of the Crop Experimentalist's section and of the staff of the Fields Division.

The method of trial consisted in the dusting, by the Instructors in Agriculture in the various districts, of one or more bags of seed for sowing in a defined area in the same paddock as the balance of the seed which had been subjected to the farmer's usual treatment. The dusting, at the rate of 1½ oz. to the bushel, was carried out in small portable machines, kindly loaned by Bayer Products, Ltd., the makers of "Ceresan New." No attempt was made to measure any differences in the results, but each trial was visited at least once by the Instructors concerned and the visual results recorded These records are collected in the following table:—

Seed-treatment with which "Ceresan New" Dust is compared.	Number of Trials.	Braird.			Crop			Smut.		
		Better.	Worse.	Equal.	Better	Worse.	Equal.	Better.	Worse.	Equal.
OATS										
No treatment ..	19	4	1	14	2	1	16	7	0	12
Formalin ..	10	3	0	7	0	0	10	0	0	10
Bluestone ..	5	4	0	1	3	0	2	1	0	4
Clarke's Protector ..	5	2	0	3	0	0	5	3	0	2
BARLEY.										
No treatment ..	2	1	0	1	1	0	1	..	..	..
Formalin ..	4	2	0	2	0	0	4	..	..	..
Bluestone ..	2	1	0	1	0	0	2	..	..	..
Clarke's Protector ..	3	0	0	3	0	0	3	..	..	..
Copper carbonate ..	3	2	0	1	0	0	3	..	..	..
WHEAT.										
No treatment ..	1	1	0	0	0	0	1	..	..	..
Formalin ..	3	1	0	2	1	0	2	..	..	..
Bluestone ..	6	5	0	1	3	0	3	..	..	..
Clarke's Protector ..	2	2	0	0	2	0	0	..	..	..
Copper carbonate ..	10	4	0	6	1	0	9	..	..	..
PEAS.										
No treatment ..	6	0	0	6	0	0	6	..	..	..

Explanation of Table.

The columns headed "Braird" refer to the appearance of the crop at or within a few weeks of germination. Where a difference was noted as a rule the Instructors stated that the germination of the "Ceresan-New" dusted seed was from two to six days earlier than the farmer's treated seed, that the stand appeared to be thicker, and that the plants were a darker green in colour. It is perhaps significant that in most of these cases the crop had actually been inspected by the Instructor at this stage, whereas where no difference was recorded the crop had been visited only at maturity.

Under the heading "Crop" are tabulated observations at or near harvest. Where a difference was noted, the comment was usually "earlier and thicker," though in one trial with oats the reverse was recorded.

Under the heading "Smut" are tabulated observations on both loose and covered smut of oats, covered smut of barley, and stinking smut of wheat. Of the 28 trials on oats recorded in the table as "equal," 16 showed no smut in the paddock. No smut was recorded in any of the trials of barley or wheat.

Summary of Results.

Out of 39 observational field trials of the effect of "Ceresan New" seed dust on oats, 13 showed a superiority in speed and vigour of germination over the farmer's own treatment, 1 was recorded as inferior, and 25 as showing no difference. At maturity 5 were recorded as superior, 1 as inferior, and 33 showed no difference.

Less smut occurred on the "Ceresan-New"-treated seed than the farmer's treated in 11 trials, 6 showed no difference, and in 22 no smut was recorded in either.

In 14 similar trials with barley, 6 showed an improved germination and early growth, while in 8 no difference was recorded. At maturity 1 trial was recorded as showing an apparently heavier yield from the "Ceresan-New"-treated seed, 13 showed no difference. No records were obtained on the relative effect of the treatments on covered smut.

With wheat in 22 trials, 13 showed a definite superiority for the "Ceresan-New"-dusted seed in the early crop stages, 9 showed no difference. At maturity 7 showed promise of a better yield, 14 showed no difference. No stinking smut was recorded in any of the trials.

On field peas in 6 trials of the effect of "Ceresan New" no differences could be detected between the dusted and undusted seed.

Discussion of Results.

The method adopted in these experiments with "Ceresan New" seed dust was designed to record only visible outstanding differences between it and other seed treatments in use on the farms. No attempt was made to obtain the exact measurements necessary for the detection of small differences in germination, yield, or disease control. Nor was there a constant method employed in making the observations—some of the experiments being visited and observed on several

occasions, others only once. No allowance has been made for the higher rate of seeding with dusted seed as compared with that treated by the various wet methods when sown with the same setting of the drill. Allowing for these weaknesses in the evidence, it is apparent that, in many cases at any rate, cereal seed dusted with "Ceresan New" showed better field germination than similar seed either untreated or treated by other commonly employed methods. In regard to its effect on the crop at harvest, the evidence is not so positive, but differences, unless of considerable magnitude, are difficult to detect at this stage. In regard to smut-control, comparisons were only possible with oats, and on this cereal the "Ceresan New" dust treatment showed at least as efficient control of the disease as either of the three wet treatments with which it was compared.*

* For fuller comparisons between the various common seed-treatments for the control of cereal smuts see articles in this *Journal*, March, April, 1934.

STATISTICAL INFORMATION RELATING TO THE DAIRYING INDUSTRY.

THE appended information, prepared under the authority of the Prime Minister, was presented to the Dairy Industry Conference held in Wellington on March last.

1.—Total Dairy Cows in Milk and Dry, and Estimated Production per Cow.

Season.	Cows.	Production per Cow	Season.	Cows.	Production per Cow.
		lb.			lb.
1923–24 ..	1,312,589	174·10	1928–29 ..	1,371,063	210·84
1924–25 ..	1,323,432	182·09	1929–30 ..	1,441,410	218·05
1925–26 ..	1,303,856	179·40	1930–31 ..	1,601,633	201·05
1926–27 ..	1,303,225	198·50	1931–32 ..	1,702,070	199·65
1927–28 ..	1,352,398	195·38	1932–33 ..	1,845,072	215·10

2. Cows milked, Total and Average Production per Cow milked.

Season.	Cows milked.	Total Production	Production per Cow (nearest Pound).
		lb.	
1929–30	1,390,000	314,000,000	226
1930–31	1,500,000	322,000,000	215
1931–32	1,582,000	340,000,000	215
1932–33	1,724,000	397,000,000	230
1933–34	1,815,000*	435,000,000*	240*

* Estimated.

The Probable Herd Position for 1934–35 Milking Season.

Statements are often heard to the effect that heavy slaughterings of dairy cows this autumn will tend to stabilize the milking-herd for 1934–35, and that this in itself will tend to restrict production. Cow population can be studied over the period 1931–1933 from actual figures, and these give some indication of the possible movement in cow numbers next year. The position may be stated as follows :—

Milking Season 1931–1932.—Total cows = 1,702,070. This herd was derived from 346,156 replacement heifers plus 1,601,633 cows from the previous season, less deaths and killings. Killings of cows for the season amounted to 126,884.

Milking Season 1932–33.—Total cows = 1,845,972. This herd was derived from 370,697 calves enumerated in 1931, which gave 365,357 replacement heifers, plus 1,702,070 cows from the previous season, less deaths and killings. Killings of cows for the season amounted to 151,997.

Milking Season 1933–34.—Estimated total cows this season in milk or dry = 1,950,000. This herd was derived from 360,697 calves enumerated in 1932, which gave 359,697 replacement heifers, plus 1,845,972 cows from the previous season, less deaths and killings. Killings of cows for the season amounted to 199,678.

Milking Season 1934–35.—380,244 calves enumerated in 1933 should give 377,000 replacement heifers for the 1934–35 herd. These, plus the 1,950,000 estimated herd for 1933–34, less deaths and killings, will represent the 1934–35 milking-herd. Deaths amount to approximately 70,000 per annum. Therefore, if 307,000 cows are slaughtered between January, 1934, and January, 1935, the herd would remain at the 1933–34 level. Any killings less than 307,000 will result in an increase in herd. It should be noted that killings of cows have been on the increase each year, the largest number being 199,678 in 1933.

For the purposes of this computation, "cows killed" are assumed to be dairy cows.

3.—Utilization of Total Estimated Butterfat Production in the Dominion.

Season.	Butterfat for Butter.	Butterfat for Cheese (including Whey Butter).	Butterfat in Milk consumed.	Butterfat in Cream consumed.	Butterfat for other Dairy-products.	Butterfat in Milk fed to Calves and in Milk and Cream spilt and wasted.	Total Butterfat produced.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1923-24	145,802,150	63,780,243	11,470,742	1,418,566	1,474,766	4,570,336	228,516,803
1924-25	160,090,656	61,020,707	11,704,612	1,447,488	1,902,311	4,819,711	240,985,575
1925-26	149,932,385	64,083,464	11,967,905	1,480,049	1,770,993	4,678,261	233,913,057
1926-27	171,329,058	66,579,951	12,209,829	1,509,967	1,890,384	5,173,861	258,693,050
1927-28	177,580,362	65,553,951	12,385,219	1,531,658	1,900,715	5,284,733	264,236,638
1928-29	191,983,119	75,391,935	12,529,237	1,549,468	1,835,348	5,781,410	289,070,517
1929-30	219,334,751	72,304,066	12,688,458	1,569,159	1,890,361	6,281,363	314,068,158
1930-31	223,733,816	75,478,174	12,863,258	1,590,776	1,900,000	6,440,123	322,006,147
1931-32	237,385,977	79,631,084	12,998,445	1,607,494	1,397,837	6,796,344	339,817,181
1932-33	282,003,967	90,877,774	13,099,374	1,619,976	1,526,242	7,941,374	397,068,707

4.—Gross Butter Imports to the United Kingdom, Calendar Years 1924–33 (in Thousands of Tons).

(From *Trade and Navigation of the United Kingdom.*)

Year.	Denmark.	New Zealand.	Australia.	Russia.	Irish Free State.	Argentina.	Sweden	Finland	Netherlands	All Others.	Total.
1924	86·7	54·3	32·5	14·1	23·1	26·9	2·9	6·7	4·6	12·8	264·6
1925	82·9	62·8	58·1	14·6	20·1	24·2	4·1	8·5	3·8	13·6	292·7
1926	95·3	57·7	37·6	13·2	24·8	25·7	7·7	9·3	7·5	12·1	290·9
1927	99·8	63·0	24·4	17·5	29·3	21·0	8·3	10·3	8·5	9·2	291·3
1928	100·8	61·4	43·6	16·8	27·9	18·2	8·8	9·9	6·5	11·9	306·0
1929	110·2	65·7	38·4	14·5	28·3	15·1	12·4	11·7	6·5	17·5	320·3
1930	115·9	78·5	47·3	8·2	26·0	20·7	13·9	11·6	4·9	14·2	341·4
1931	123·3	96·8	77·9	20·2	19·0	18·7	10·6	12·7	4·8	19·5	403·5
1932	129·2	111·2	89·8	16·2	15·7	19·5	8·8	10·8	2·3	18·9	422·4
1933	126·0	125·6	84·7	28·1	18·9	10·1	11·3	6·7	7·3	23·0	441·7

5.—Gross Cheese Imports to the United Kingdom, Calendar Years 1924–33 (in Thousands of Tons.)

(From *Trade and Navigation of the United Kingdom.*)

Year	New Zealand	Canada.	Netherlands	Italy	Australia	All Others	Total
1924 ..	74·0	50·3	7·2	6·9	2·3	3·7	144·4
1925 ..	69·6	62·7	7·1	8·1	4·0	3·6	155·1
1926 ..	74·9	52·8	9·4	7·1	2·3	4·1	150·6
1927 ..	80·6	42·2	11·4	7·1	1·8	4·4	147·5
1928 ..	77·8	46·0	11·4	7·1	3·7	4·3	150·3
1929 ..	90·0	36·2	9·8	6·6	2·5	4·6	159·7
1930 ..	98·0	33·9	9·2	7·2	2·4	4·9	155·6
1931 ..	86·6	35·3	8·4	6·6	3·4	3·9	144·2
1932 ..	92·6	37·4	8·5	5·3	3·7	2·8	150·3
1933 ..	102·0	31·5	6·1	4·5	4·5	2·3	150·9

6.—Gross Monthly Butter Imports to the United Kingdom from New Zealand, Australia, Denmark, and other Countries, in Thousands of Tons.

—	New Zealand.	Australia.	Denmark	Others.	Total.	New Zealand	Australia	Denmark.	Others	Total.
	1932.					1933.				
January	12·8	9·2	8·7	4·9	35·6	12·7	12·0	8·7	3·9	37·3
February	10·4	11·6	9·0	5·4	36·4	9·5	9·2	8·6	4·0	31·3
March ..	12·9	8·9	7·3	3·7	32·8	13·9	11·7	10·0	5·8	41·4
April ..	9·3	5·6	9·1	6·0	30·0	11·0	9·4	11·2	6·6	38·2
May ..	8·7	5·9	12·8	7·4	34·8	8·7	8·7	11·9	9·0	38·3
June ..	7·1	6·1	14·3	11·7	39·2	12·8	4·0	13·3	12·6	42·7
July ..	7·4	4·4	13·4	15·0	40·2	6·3	2·3	12·2	15·8	36·6
August ..	5·1	5·7	13·0	10·8	34·6	11·3	2·2	10·8	16·6	40·9
September	7·7	4·5	11·0	11·8	35·0	7·9	1·6	11·2	11·4	32·1
October ..	3·1	5·4	10·7	8·8	28·0	7·6	3·5	9·7	9·2	30·0
November	11·3	8·5	10·1	3·8	33·7	11·4	6·5	8·9	5·2	32·0
December	15·4	14·0	9·8	3·0	42·2	12·5	13·6	9·5	5·3	40·9

7. Average Monthly Quotations for New Zealand and Danish Butter (in Shillings per Hundredweight).

(From Dairy Control Board Cables.)

Month.	New Zealand. 1932.	Danish. 1932.	New Zealand. 1933.	Danish. 1933.
January	97·0–100·0	124·0–125·2	80·5– 81·7	109·0–111·0
February	104·5–106·7	141·5–143·0	76·0– 78·5	107·0–107·2
March	108·0–110·0	125·0–126·5	72·2– 74·6	95·2– 97·6
April	104·2–106·8	116·0–116·8	66·7– 68·7	93·2– 94·0
May .. .	95·0– 97·0	103·5–104·2	76·2– 78·2	92·0– 93·5
June	95·5– 97·5	100·5–101·7	78·4– 80·6	89·6– 90·8
July	102·6–104·2	110·8–112·4	78·5– 80·0	94·5– 96·5
August	106·5–109·2	111·5–113·2	87·5– 89·5	102·7–103·7
September ..	109·6–113·8	121·8–123·6	98·4–101·8	112·4–113·6
October	101·0–110·2	118·0–119·0	94·7– 99·0	111·2–112·2
November ..	89·7– 95·5	121·5–123·0	81·7– 86·2	118·2–118·5
December .	82·8– 84·6	121·2–122·4	67·8– 69·8	109·2–110·2

8. Payout for Butterfat received at Butter, Cheese, and Dual Factories.

(From New Zealand Factory Production.)

Season.	Pence per lb.	Total Payout £ (N.Z. Currency).	Season.	Pence per lb.	Total Payout £ (N.Z. Currency).
1919–20 .	20·77	9,312,959	1927–28 .	17·99	17,306,433
1920–21 ..	28·10	14,671,660	1928–29 .	18·48	19,597,810
1921–22 .	14·45	10,129,221	1929–30 .	16·25	19,145,717
1922–23 ..	17·18	14,376,656	1930–31 .	11·58	14,023,477
1923–24	15·57	13,929,235	1931–32	11·03	13,971,280
1924–25 ..	16·90	14,901,634	1932–33 .	8·93	13,485,246
1925–26 ..	18·21	15,490,121	1933–34 ..	8·00*	13,375,000*
1926–27 .	15·38	14,345,782			

* Estimated.

9.—World Production of Margarine (Tons).

	1930	1931.	1932.
United States of America ..	140,000	102,658	90,667
Holland	110,000	90,000	80,000
Great Britain	220,000	228,000	195,000
Germany	480,000	450,000	440,000
Denmark	80,000	79,000	75,000
Norway	50,000	48,000	45,000
France	40,000	40,000	32,000
Sweden	55,000	51,000	50,000

These figures are according to Frank Fehr and Co.'s "Oilseed Review for 1932."

10.—Consumption of Margarine in United Kingdom.

—	1924.	1931.	1932.	1933.
	Tons.	Tons.	Tons.	Tons.
Imports	65,767	34,665	4,619	1,626
Home manufacture* ..	183,175	193,000	191,000	177,000
	248,942	227,665	195,619	178,626
Less exports.. ..	2,141	10,025	3,913	1,737
	246,801	217,640	191,706	176,889
	lb.	lb.	lb.	lb.
Consumption per head ..	12·35	10·55	9·3	8·5

* Estimated, but considered reliable.

NOTE.—In both Holland and Germany severe restrictions have been imposed upon the margarine trade—in Holland by the compulsory incorporation of a minimum quantity of butter (40 per cent. at present) and in Germany by regulation of production per factory plus a heavy tax Denmark has also imposed a heavy tax on margarine.

11.—Consumption of Butter in United Kingdom.

—	1924.	1931.	1932.	1933.
	Tons.	Tons	Tons	Tons.
Imports	264,638	403,558	418,218	441,726
Home make ..	40,000	40,000	40,000	40,000
	304,638	443,558	458,218	481,726
Re-exports .. .	9,553	17,572	15,272	4,285
	295,085	425,986	442,946	477,441
	lb	lb.	lb	lb
Consumption per head	14·76	20·66	21·48	23·16
	lb	lb	lb	lb
Total butter and margarine consumed per head	27 11	31·21	30·78	31 66

12 DAIRYING IN GREAT BRITAIN AND MILK MARKETING SCHEME.

(a) The Extent of Dairying in Great Britain.

Dairying is, next to meat, the most important branch of the British agricultural industry. Out of a total consumption of dairy produce valued at £113,000,000 some £59,000,000 is produced locally in Great Britain. The corresponding figures for meat show a local production of £69,000,000 out of a total consumption figure of £155,000,000.

The following tables appearing on page 199 of the Report of the Reorganization Commission for Milk gives an estimate of the total quantity of milk produced in Great Britain and how it is marketed or utilized :—

(b) Estimate of Utilization of Milk-supply of Great Britain in 1924 25 and 1930–31.

Channel of Utilization.	Quantity.		Fresh Milk Equivalent.		Fresh Milk Equivalent as Percentage of Total.	
	1924–25.	1930–31.	1924–25.	1930–31.	1924–25.	1930–31.
Liquid milk—	Mil. gals	Mil gals.	Mil. gals.	Mil. gals	Per Cent	Per Cent.
Consumed on farms	108·6	73·0	108·6	73·0	8·4	5·1
Consumed off farms	787·8	873·9	787·8	873·9	61·2	61·3
Total ..	896·4	946·9	896·4	946·9	69·6	66·4
Butter—	Cwt.	Cwt				
Made on farms ..	621,000	702,800	164·1	185·6	12·7	13·0
Made off farms ..	52,000	94,400	13·7	24·9	1·1	1·8
Total ..	673,000	797,200	177·8	210·5	13·8	14·8

(*b*) *Estimate of Utilization of Milk-supply of Great Britain in 1924-25 and 1930-31*—continued

Channel of Utilization.	Quantity.		Fresh Milk Equivalent.		Fresh Milk Equivalent as Percentage of Total.	
	1924-25.	1930-31.	1924-25.	1930-31	1924-25	1930-31
	Cwt	Cwt	Mil. gals	Mil. gals.	Per Cent.	Per Cent.
Cheese—						
Made on farms ..	647,500	689,800	72·7	77·4	5·6	5·4
Made off farms ..	214,000	532,000	24·0	59·7	1·9	4·2
Total ..	861,500	1,221,800	96·7	137·1	7·5	9·6
Cream—	Gals	Gals				
Sold by farmers ..	856,000	1,714,000	10·5	21·1	0·8	1·5
Sold by others ..	2,280,000	1,806,000	30·9	24·6	2·4	1·7
Total ..	3,136,000	3,520,000	41·4	45·7	3·2	3·2
	Cwt	Cwt				
Condensed milk ..	783,000	803,800	21·3	24·3	1·7	1·7
Milk-powder ..	123,000	139,700	9·6	11·0	0·7	0·8
Other milk-products	77,000	35,000	6·5	3·0	0·5	0·2
Estimate for unrecorded firms	..	.	..	4·0	..	0·3
Wasted ..	..		38·3	43·0	3·0	3·0
Grand totals ..		.	1,288·0	1,425·5	100·0	100·0

(*c*) *The Average Annual Gross Imports of Milk and Milk-products from British and Foreign Countries, and the Average Annual Net Imports from all Sources, and the Milk Equivalents of these Imports, for the Years 1929-31*

Product.	Gross Imports. British Countries. Quantity		Foreign Countries. Quantity		Total. Quantity		Net Imports. Total. Quantity	
	Quantity	Milk Equivalent	Quantity	Milk Equivalent	Quantity	Milk Equivalent.	Quantity	Milk Equivalent.
	000 Cwt	Mil gals	000 Cwt	Mil gals	000 Cwt	Mil gals	000 Cwt	Mil gals.
Fresh milk	59	0·64	4	0·04	63	0·68	63	0·68
Cheese . ..	2,602	291·94	395	44·32	2,997	336·26	2,967	332·90
Condensed milk, whole ..	42	1·14	627	17·06	669	18·20	663	18·03
Milk-powder, sweetened	13	1·02	..	..	13	1·02	13	1·02
Butter	3,238	855·16	3,855	1,018·10	7,093	1,873·26	6,877	1,816·22
Cream (Irish) .. .	74	11·18	..	..	74	11·18	73	11·02
Cream (other)	..	..	77	5·24	77	5·24	76	5·17
Preserved milk, other kinds (half-cream)	0·5	0·04	3·6	0·31	4·1	0·35	3·5	0·30
Total of whole milk equivalent	..	1,161·12	..	1,085·07	..	2,246·19	..	2,185·34
Condensed milk, separated or skimmed	60	1·93	1,955	62·75	2,015	64·68	2,104	67·54
Milk-powder, unsweetened	141	16·72	148	17·55	289	34·27	273	32·38
Total of skimmed milk equivalent	..	18·65	..	80·30	..	98·95	..	99·92

The above table is taken from Report of the Reorganization Commission for Milk, Ministry of Agriculture and Fisheries, Econ. Series No. 38, page 215.

DIVERSIFICATION AS A MEANS OF MAKING DAIRYING SAFER AND MORE PROFITABLE.

1. POTENTIALITIES IN FAT-LAMB PRODUCTION ON PORTIONS OF SOME DAIRY-FARMS.

W. J McCULLOCH, Fields Superintendent, and R P. CONNELL, Fields Division, Palmerston North.

DIVERSIFICATION SUGGESTED BY EXPERIENCE.

FREQUENTLY history intelligently interpreted in relation to current circumstances is of value as a source of guidance, and, in view of the national concern that the difficulties of the dairy industry of the Dominion are now causing, certain facts of the history of the agriculture of important tracts of both the old and the new world seem to point to the advisability of considering the merits of diversified or mixed farming in comparison with those of specialized or one-crop (including one class of stock) farming.

While the maintenance or improvement of soil fertility, which is one of the principal advantages of mixed-farming systems in regions devoted dominantly to annual arable crops, is of relatively little moment in regions in which grass farming is dominant, yet experience shows that associated with diversified farming there are other substantial advantages which promise to be of importance in the position which it is generally expected the dairy industry will have to face in the immediate future. History shows that periods of marked price fluctuations, such as have followed great wars, overproduction, succession of adverse seasons, &c., have almost always brought about distress to specialized or one-crop farming regions. Diversification on the other hand has tended to assure a uniformily better living by giving greater independence of market variations and price fluctuations which often affect one product more than others. Incidentally, diversification alone is far from being the key to universal continuous prosperity; it is well known that some farmers do not obtain success even under the most favourable circumstances. But it has been demonstrated that much can be expected from the combination of appropriate diversification with efficient farm practice and reasonable industry and thrift.

It is interesting to note the present degree of diversification in Danish farming, which until about the "seventies" or "eighties" of last century was essentially a system of corn-growing. The general position in Denmark, the farming-area of which is approximately one-sixth the occupied area of New Zealand, is indicated by the fact that in 1928 Danish farmers derived income(7) from 1,579,000 dairy cows, 5,350,000 slaughtered pigs, 23,000,000 poultry, and 85,000 acres devoted to specialized seed-production. According to Faber(1) the area devoted to seed-culture in 1907 was less than 10,600 acres. The corresponding position in New Zealand is indicated by the fact that at 1st January, 1933, the number of dairy cows, including dry cows, was 1,845,000, the number of pigs slaughtered for the year was 624,000, and the number of poultry, when the figures were last obtained in 1926, was 3,800,000.

Briefly, the position is that in relatively modern times many farming regions have passed through various stages of development of a nature

which seems to carry a lesson to our dairying industry. As the pioneers usually had to obtain their living largely on the farm they usually produced a diversity of crops and stock. When transportation facilities improved the crop most easily and profitably grown as a rule became a specialty, and often was grown exclusively. Later, for different reasons under different circumstances, this special crop began to fail, and a change to diversified farming became necessary. The diversified era of farming became a more permanent and relatively prosperous development. The question of practical current moment is whether diversification can be employed successfully to alleviate enduringly the dairying industry of New Zealand.

Possible Scope for Fat-lamb Production in Dairying.

A type of diversification which has been proposed is the utilization of some of the grassland of a certain proportion of our dairy-farms for fat-lamb production instead of for butterfat production. Whether the replacement of dairy cows by breeding-ewes would prove sound farm economy is governed by several matters, among which the following are of basic importance: (1) The relative feed requirements of the two classes of stock; (2) the relative returns from the two types of production; (3) the labour position which arises from carrying the two classes of stock on the one property.

THE RELATIVE FEED REQUIREMENTS.

Though it is at times considered that good dairying pastures are to some extent necessarily unsatisfactory for sheep, it seems likely that this belief often is based not on fact but on confused thought: at times it would seem that it is not the pasture itself but the grazing management of the pasture which brings about comparatively unsatisfactory results with sheep on pastures of accepted good dairying type. In some support of this view is the fact that in respect to nutrition the requirements of the dairy cow and the breeding-ewe are essentially the same—both require feed which is highly digestible, rich in proteins required for milk and flesh production, and rich in mineral compounds containing phosphates and lime which are required for milk and bone production. In further support of the same view is the fact that successful sheep-farming has been carried out for years on land adjacent to and similar to that on which from 250 lb. to 300 lb. of butterfat an acre has been produced.

The fact that the feed requirements of the dairy cow and of the breeding-ewe are essentially the same warns against the danger involved in having these two classes of stock competing on the same pastures for feed which tends at all to be in scant supply, and points to the advisability of making butterfat production and fat-lamb production completely self-contained ventures even when they are carried out on the same farm. While it is not necessarily impossible to have these two types of production carried out concurrently with success on the same pastures, it is well to realize there is an inherent danger in having cows and ewes attempting to share satisfactorily the same feed-supply.

THE RELATIVE RETURNS AND LABOUR REQUIREMENTS.

A question of primary importance is how the rent or interest charges that could be borne by a dairy-farm would be affected if portion of the farm were devoted to fat-lamb production. The returns and the labour

costs which largely determine the rent that could be paid are governed so much by management that general statements are of little value. But what can be achieved in a specific instance by really good pasture management has been demonstrated on the farm of Mr. Phillips at Marton, where the main feature is fat-lamb production.

Method and Results of Special Grazing Management on a Marton Sheep-farm.

Probably the most important management factor which is chiefly responsible for the remarkably high carrying-capacity of this property, when compared with that of the majority of other farms in the same district, is the manipulation of stock The area of the farm is 100 acres. and in every respect the land is typical of a large surrounding district.

From an original carrying-capacity of between three to four breeding-ewes per acre, which is substantially that of similar land in the surrounding district to-day, the system evolved by Mr. Phillips over the past seven years has enabled him to winter and lamb eight and three-quarter breeding-ewes per acre during the past season, and it is the considered opinion of the owner that the maximum has not yet been reached.

A most intensive form of rotational grazing is practised by concentrating the whole flock in one paddock and shifting daily, and for this purpose the 100 acres is subdivided into fourteen paddocks averaging approximately 7 acres each. Till lambing commences the 870 breeding-ewes receive a fresh paddock each morning As a consequence each paddock provides one day's grazing and is then allowed thirteen days to recover. So far the remarkable increase in carrying-capacity has resulted without the provision of any arable supplementary crop being produced on the farm. During the past three seasons one 7-acre paddock has been saved for hay, but the owner asserts that there appeared to be no great need for this, as sufficient grass growth was always in evidence. Last spring, for the first time, 22 tons of mangels were purchased and fed over a period of six weeks to the flock of 870 breeding-ewes: this provided less than 1½ lb. of mangels per head daily. The daily shifting is carried out without the aid of dogs, and the owner explains that the sheep soon become familiar with the daily routine, and all that is necessary is to stand at the open gate and regulate the movement of the mob to avoid crushing. All paddocks are taken in regular turn, and driving through one paddock to reach another is avoided. When lambing commences Mr. Phillips's usual procedure is varied, and is contrary to the customary practice on most sheep-farms. Each morning as lambs begin to appear the ewes not yet lambed pass on as usual to the fresh paddock leaving behind all ewes which have lambed so that the freshly lambed ewes remain a day longer in the same paddock. Next morning a further number of lambed ewes stay behind while the main flock passes on to another fresh paddock. The first lot of ewes and lambs are now joined up with the second lot, and this system is followed until a flock of from eighty to a hundred lambed ewes is collected. Then this small flock also begins to have daily shifts to fresh paddocks, and as further additions are gradually made to this flock the number in the flock not yet lambed correspondingly decrease. Eventually two flocks of ewes and lambs are formed, and each continues to receive its daily shift. About this time grass-growth is sufficiently vigorous to allow

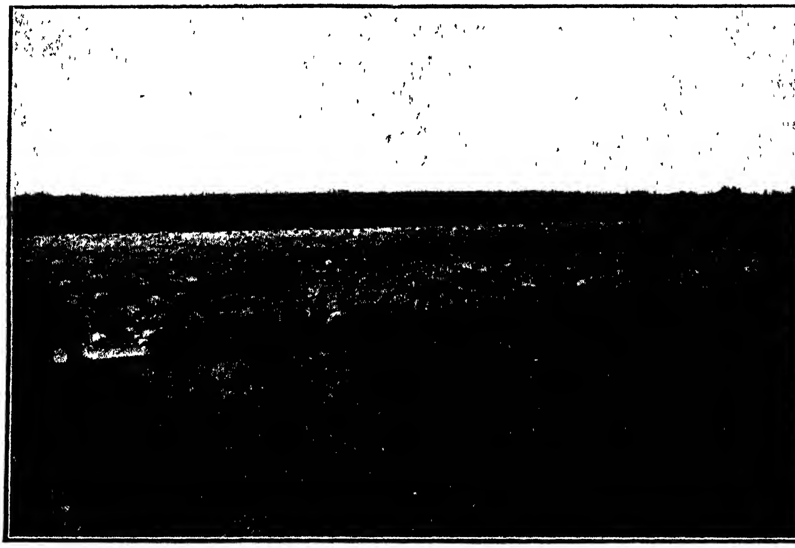


FIG. 1. A GENERAL VIEW OF THE EWE FLOCK IN A 7-ACRE FIELD.

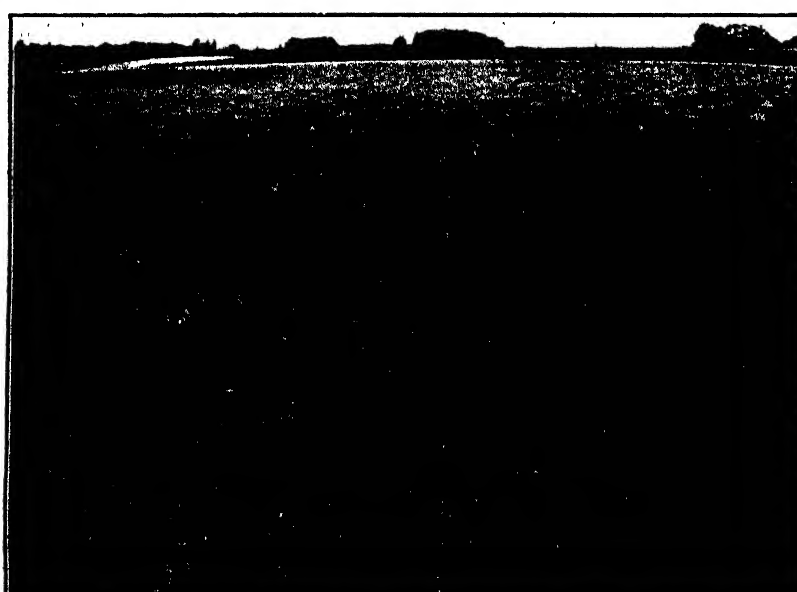


FIG. 2. A PASTURE THE DAY AFTER GRAZING.
The pasture is not as fouled as might be expected.

recovery to take place by spelling for intervals of a week. Growth continues to increase, but the young lambs soon begin to assist in controlling it, and so the pastures are kept short and leafy.

No dogs are used when shifting takes place, and the sheep are naturally very quiet in consequence. The lambing consistently has been in the vicinity of 100 per cent., and the total loss last season was sixteen lambs. The loss in ewes throughout the whole season last year was heavier than usual, and amounted to less than 4 per cent. The sale dockets examined indicated that 470 lambs, showing weights of from 31 lb. to 33¾ lb., were drafted to the freezing-works before Christmas, followed by a further draft in February, and the tail end in March. The return for lambs worked out at slightly over £1 per head. The ewes clipped over 8 lb. per head in the past season, and the wool realized 11d. per pound at the second Wanganui sale.

The practice of buying full-mouthed ewes each season is generally followed, and lambing is timed to commence in August. Earlier lambing is not favoured. Water is gravitated over the farm from a large concrete tank, and each pair of paddocks is served with a concrete trough.

The manuring programme is to top-dress annually with 4 cwt. of artificial fertilizer per acre in the autumn, and within the last few years lime has been regularly applied.

At time of writing—mid-April—there are on the property 920 breeding-ewes in lamb which the owner proposes to carry through the coming winter, and in addition there are 130 cull ewes and 200 lambs being fattened on grass (The fat-buyer has since taken drafts.)

The total sheep on this 100-acre farm in April was 1,250.

Discussion of Methods and Results.

The grazing management followed by Mr. Phillips is, in its fundamental features, a successful adaptation to sheep-farming of the method of grazing management which has been giving outstanding results in dairying. In one instance which has been recorded(2) the butterfat production was increased in one year from 159 lb. to 216 lb. an acre without any material additional outlay or change in the herd. Further, at Marton Experimental Area, with sheep grazed on pastures comparable to those on Mr. Phillips's property, a carrying-capacity at least equivalent to that achieved by Mr. Phillips was readily obtained(3).

The essential features of this type of grazing management are—(*a*) intermittent grazing and spelling of each field; (*b*) the periods of spelling are of relatively short duration and consequently the grazing periods are correspondingly short; (*c*) really close grazing is not carried out. Stock are removed from a field when there is still much fresh growth on it.

Mr. Phillips's practice of restricting the grazing periods to one day's duration is an essential feature of the system. One of the objections commonly raised to periodical changing of breeding-ewes from one paddock to another between lambing-time and the sale or weaning of their lambs is that the change in feed which the change in paddock almost always brings about is detrimental to the progress of the lambs. This undoubtedly is a well-founded objection if any substantial change

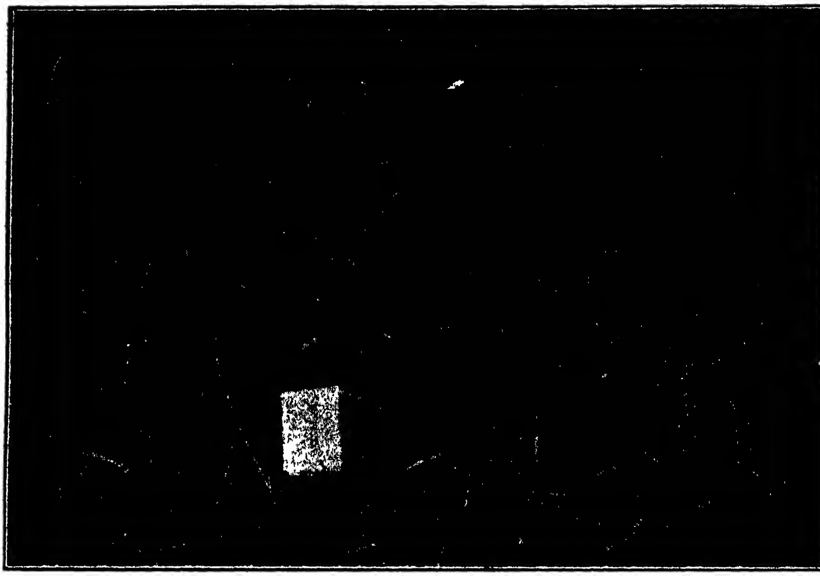


FIG. 3 A CLOSE-UP VIEW OF A PASTURE READY TO BE GRAZED.
Rich in vigorous rye-grass and clover

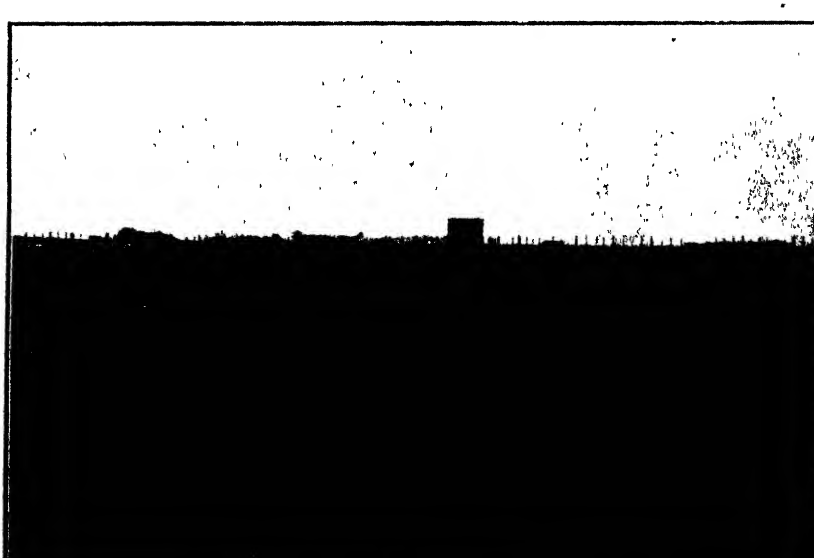


FIG. 4. THE CONCRETE TANK FROM WHICH WATER IS DISTRIBUTED TO EVERY FIELD ON THE FARM.

in feed occurs, but the system described above results in the sheep having access daily to a fresh supply of young, leafy pasture, so that actually throughout the whole season the character of their feed is as uniform as it is practicable to make it under any system of grazing. Long periods of spelling, though possible, are not desirable in dairying. With sheep they would be impracticable in spring and summer, as they would result in the feed getting beyond the stage of growth at which it is suitable for sheep. Under Mr. Phillips's system the fields are grazed during much of spring and summer at intervals of from six to seven days.

The fact that the system does not entail hard grazing is of much moment. Firstly, it minimizes the injury which is caused by the defoliation of the pasture plants(4),(5). Consequently it lessens the period occupied in recovery and return to the stage of relatively rapid rate of growth. This provides a partial explanation of the increased carrying-capacity under the system. Secondly, it means that the sheep are not punished in respect to feed in the manner necessary to effect really hard grazing.

The system practised by Mr. Phillips obviates to a substantial extent both the overgrazing in winter and the undergrazing in spring and summer which in many farms either is not obviated or is obviated to some extent only by the seasonal grazing of additional stock—usually cattle. It has been established that grazing management which leads to overgrazing in the winter and undergrazing in the spring and summer results in a deterioration in the botanical composition of the sward(6). The avoidance of this deterioration probably assists in begetting the increased carrying-capacity possible under the system.

A disadvantage believed to attach to the periodical changing of ewes and young lambs from paddock to paddock is that necessarily it would bring about "mis-mothering." The results of the practice described above have demonstrated that "mis-mothering" can be avoided. The sheep soon become accustomed, as soon as the gate is opened, to pass of their own accord from one field to the next. Only experience will show whether sheep will pass as readily from larger paddocks—say, ones of from 25 acres to 50 acres—as they do from the ones of 7 acres. If they do, then the size of paddocks is immaterial: it will be necessary to have only about fourteen paddocks irrespective of whether the area devoted to sheep be 100 acres, 300 acres, or 600 acres.

The top-dressing carried out by Mr. Phillips is an important factor in the attainment of a carrying-capacity exceptionally high for his conditions. But it is considered to be by no means such a dominant factor as is his method of manipulating the grazing of the sheep. Further, enrichment of the supplies of plant-food materials may be attributed not only to the applications of lime and artificial fertilizers but also to the animal excreta to which may be attributed a considerable amount of the vigorous growth of the pastures, especially in the colder seasons in which growth normally is relatively dormant.

Mr. Phillips utilizes pastures which in respect to composition and vigour would prove eminently suitable for dairying. This is of some significance relative to the possibility of fat-lamb production being carried out instead of butterfat production on portions of some dairy-farms. Important aspects of this matter are—(1) The method of grazing management carried out by Mr. Phillips would be practicable

only when the flock of ewes and the herd of cows operated at any one period as separate units, each grazing exclusively its own pastures. (2) Only experience will show the minimum size of paddocks that can be grazed successfully by sheep under this method. It is believed tentatively that paddocks less than 4 acres in area might not prove economically successful, partly because overhead charges in respect to provision of water and to subdivision become greater per acre as the size of the paddock decreases. If this belief proves well-founded, then the area of the minimum portion of a dairy-farm that could be diverted to fat-lamb production under this method would approximate 50 acres, and so the application of the method would be restricted to relatively large dairy-farms--ones so large that, having been reduced 50 acres or more in area, they would still support a dairy herd of economic size. Further, the portion devoted to fat-lamb production should be in one block of such a shape that the ewes can be transferred directly from paddock to paddock. The application of the method to farms devoted essentially to fat-lamb production is also worthy of consideration.

It is not known that Mr. Phillips's method as herein described is the best possible one for his or for any other circumstances: only exhaustive and extended investigation which has not been carried out would provide definite knowledge on this point. Nor, even in the light of the imperfect present knowledge, is it considered to be necessarily the method which should be followed generally in all details. This description of the method has been given merely to indicate to others what one farmer is doing; it remains for other farmers to consider carefully the potentialities of the method relative to their own conditions.

About the method two positive statements can be made with assurance: (1) Over several consecutive years the method has given Mr. Phillips exceptionally good results. (2) In the light of modern grassland knowledge it is fundamentally sound as a means to vigorous pastures of heavy yields of highly nutritious feed.

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INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 8th March to 22nd March, 1934, include the following of agricultural interest —

No. 70034: Hay-sweep; H. R. Saunders. No 70324: Mixing manures; C. C. Selwood. No. 69288: Emulsifying dairy-products; C. Doering and H. H. Doering. No. 70050 and No. 70099: Hay-sweep; H. R. Saunders. No. 70119: Spout for milk-bottle; R. R. Mason No. 70531: Milk-cooler; O. A. White. No. 70577: Forcing powder into rabbit-burrow, F. W. and C. H. Bycroft. No. 70601: Packing fruit; W. H. Cassell and F. E. Dahn. No. 70615: Cattle-drenching apparatus, E. F. Murphy. No. 70703. Releaser; S. Oldfield. No. 71158: Moth destroying; V. Leggo and Farmers Ltd. No. 71211: Wheat-treatment: J. A. S. Marris. No. 71509: Dehorner; E. T. Mercer.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

PAMPAS GRASS AS WINTER COW-FEED.

B. C. ASTON, Chief Chemist, Department of Agriculture

IN this *Journal* for October, 1932, was given some account of the successful utilization of the tall South American plume grass known as pampas grass (*Gynerium (Cortaderia) argenteum*), universally grown as an ornament in gardens where it produces tall dense tussocks which, including the flowering stalk and plume, attain a height of 10 ft. to 12 ft. When grown in gardens the mass of material produced in the course of years presents a bulk of herbage which would not impress any one, least of all a dairy-farmer, as being likely to prove an attractive feed for cows, the persistent dead leaves of the tussock mixed with the tall coarse leaves showing a dry innutritious-looking mass When, however, dead or old leaves are prevented from accumulating by firing every year after cattle have eaten down the succulent green portions and some of the dead leaves also the subsequent growth is tender and easily grazed by cows Knowing that this material grows at the rate of a foot a month and produces per acre 50 tons of green edible matter of higher dry-matter content than turnips or mangels, that it will be greedily eaten by cows in the winter, that it cannot spoil with bad weather (drought, heavy rains, or gales), that it requires no weeding, no cultivation, and no fertilizer and hardly any attention after once planting, the rapid growth of green succulent leaves is impressive in the extreme The clumps will grow on any kind of soil and, when possible, throw down roots to a depth of 8 ft. below the surface, which enables the giant tussock to search over a large area for the plant food and water which it requires One can easily imagine the average dairy-farmer being sceptical as to the good news and looking for the catch in the system which in the Northern lands, at least, does away to some extent with the laborious hay and silage making and root-growing. The method is being thoroughly tested by independent farmers in the Waikato and Mr McClean is distributing roots of the grass as far south as Wellington. Arrangements are being made to test the use of this grass on the pumice lands where it grows vigorously and where it can have such a good root-run in that deep permeable soil.

In spite of the sometimes pathetic attempts of cattle to get at pampas and devour it, these attempts have been disregarded as evidence that it might be desirable to cultivate it for food purposes ; in spite also of the advice of two eminent men—Sir George Grey and Dr. Curle—who seemed to anticipate its future value. One observer tells how cows will lie down on their sides in an endeavour to get their heads under the bottom wire of a fence to eat the pampas, often destroying fences in their attempts to get at this favourite fodder. When this happened the farmer merely strengthened his fences, shutting his eyes to the value of such evidence. One farmer, Mr. George Short, of Dargaville, writes that twenty-two years ago he had his first experience of pampas, and since then he has always grown it for shelter and stock-food, for in winter all stock are fond of it, breaking down good fences to get at it. He has grown it on drain banks, in paddocks, and on hill land. It grows as well on poor gum land as it does on good swamp land. It would be a great asset to exposed farms near the coast where other shelter cannot thrive

owing to salt winds. Mr. Short has not grown it for fodder alone, but knows its value as stock-food. He sends photos of hedges he planted at Turiwiri, Northern Wairoa, one of the oldest of which is six years old and 10 ft. high and shows signs of being well grazed as far as cattle can reach (see Fig. 1).

To Mr. Alec McClean, of Waitakaruru, Hauraki Plains, must, however be given the great credit of being the first to profit adequately from his observations that cattle are inordinately fond of pampas in the autumn, by systematically planting and using it as winter feed as described in the previous article. Since then, Mr. McClean has extended his plantations and has continued to use pampas systematically as winter food and has answered all inquiries which have come from both local and overseas farmers. He has willingly received and explained to deputations of agriculturists, chemists, veterinarians, pressmen, and other farmers his method. He has also supplied, at a nominal price,

FIG. 1. SIX-YEAR-OLD HEDGE AT TURIWIRI, NORTHERN WAIROA.
[Photo, Geo. Short.

roots to those desiring to make experiments. Success has not come to Mr. McClean without perseverence in the face of many obstacles. Without knowing any of the previous opinions or work of others with pampas, and without any official guidance and advice, and, as he puts it, in the face of all sorts of discouragement and carping criticism which required quite a lot of determination to disregard, he has demonstrated beyond doubt that a new fodder plant is available which is destined, it is thought, to have very far-reaching effects in cheapening production in every branch of cattle-farming.

Being a grass, this new fodder is particularly suitable for balancing the diet of cattle when the tendency is for the protein of the natural diet, pasture, to rise to excess of requirements as exhibited by many high fertility pastures in late summer and autumn when clovers often predominate to such an extent that the pasture presents the appearance of a clover ley. Green maize is often used as a summer supplementary soiling crop for dairy cattle, but the production of green maize is expensive, considering that the plants only last one season and require preparation

of the soil, manuring, and finally carting of the crop, all involving labour and expense, whereas pampas is a perennial crop which can be grazed *in situ*, and will smother all competing weeds. The charge made for the roots is £1 10s. per 100 f.o.r., so that the cost for an acre is £15, and two years from the date of planting, as well as in subsequent years, it will support with suitable run-off over fifty head of mature stock for ten weeks, so that, viewed as an investment, the plantation of 1 acre of pampas is an eminently payable proposition.

The writer does not advise farmers to go to the expense of buying enough plants for an acre until they have tested the matter on a small scale. In gardens this plant is apt to outgrow its welcome and when once a clump has established itself in a garden it requires considerable effort to eradicate or even reduce it. Hence any farmer desiring plants

FIG. 2 ALL THAT REMAINS OF 2 ACRES OF PAMPAS GRASS AFTER 130 HEAD OF GROWN STOCK HAVE WINTERED THEREON FOR TEN WEEKS.

Burning the rubbish is all that needs to be done before closing up for next winter's feed. [Photo, C. R. Taylor.

has only to ask his friends who will probably be glad to give him permission to take as much as he wants, but this will be a strong man's job.

Pampas does not appear to spread from seeds in the southern portions of the North Island, but in the Auckland and North Auckland districts it is regenerating rapidly by this method, especially on railway enclosures and waste lands. It is readily distinguished from toetoe by the stouter, taller habit and denser plumes.

The result of pampas feeding on Mr. McClean's own cattle has been the subject of investigation by competent visitors who have expressed their appreciation of the condition of the stock on the farm. Although milking what is called "a very ordinary herd," mostly Jerseys, he is topping his district against all suppliers for amount of butterfat per cow per month, which is shown by the factory returns, although many

of his neighbours have well-bred stock with high butterfat records. Mr. McClean's results are all the more remarkable as no top-dressing is done on his farm. The soil is not excessively moist in Ngatea and in summer months it becomes decidedly dry. The soil is peaty, the sub-soil being a rich clay. For further information of the Hauraki Plains soils see this *Journal*, June, 1914.

Mr. C. R. Taylor (country assistant to the Chemistry Section at Rotorua), with a view to determine the value of pampas in the pumice lands, met Mr. McClean at Rotorua and at his request afterwards visited his farm at a time when the pampas feeding was in full swing—August,

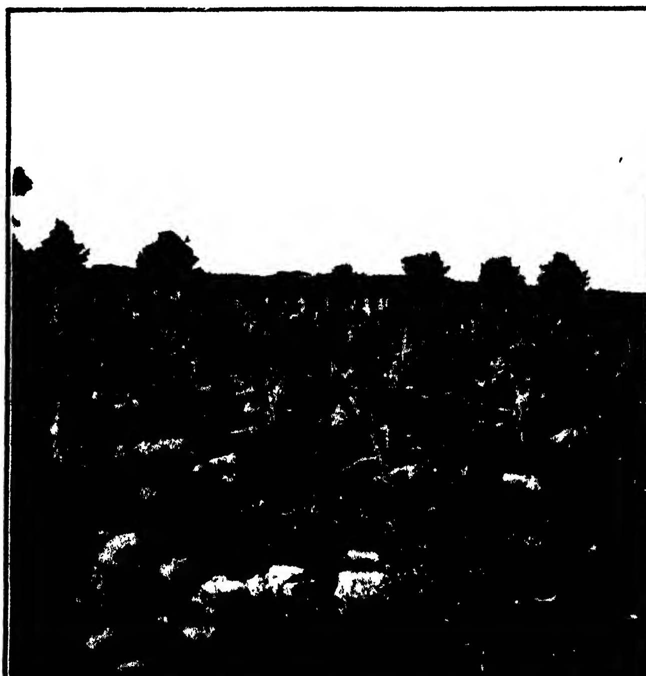

FIG 3 A NEW STAND OF PAMPAS GRASS JUST PLANTED: PLANTS ARE 6 FT APART, TWENTY ROWS WIDE.

[*Photo, A. McClean.*

1933—a previous visit having been made in midsummer. His photos show that the stock are in wonderful condition and attack the giant tussocks with evident relish, which is not the result of undue starvation, but the palatableness of the pampas. Nothing appears to be wasted, as the stock eat the tufts almost to the ground including some of the dried-up material—even the plumes.

Mr. McClean's method of laying out his plantations is simple and efficient. An area 1 to 2 chains wide and several chains in length is planted in the spring with pampas roots 6 ft. apart which provides approximately one thousand plants to the acre. These are not fed off until the second year, by which time the estimated yield of green

material per plant is, roughly, 1 cwt., or 50 tons to the acre. This figure, so far as weight is concerned, compares more than favourably with the yield of the average swede crop as grown in New Zealand. In dry matter the pampas is much richer than swede or mangel. During the winter ending September, 1932, Mr. McClean wintered 106 head of grown stock on 2 acres of pampas with only a 40-acre run-off paddock. This gives some idea of the great ultimate winter carrying-capacity of his 200-acre farm when the whole 10 acres of pampas now being grown is ready to feed off. It is considered that it will not be necessary to grow more than 10 acres for winter feed when the farm is fully developed and stocked to capacity.

During the past winter Mr. McClean has fed 130 head of grown stock and 70 head of young stock on 2 acres of pampas with a run-off of 48 acres. Feeding-off was commenced on the 14th June, 1933,

FIG 4. CATTLE ON LAST "BREAK" OF ORIGINAL 2 ACRES

Note condition of stock and the manner in which pampas tussocks in foreground have been eaten down

[*Photo, C R. Taylor*

and finished on the 20th August, a period, approximately, of ten weeks. Reckoning two thousand plants to the 2 acres, this provides two hundred plants per week for 130 head, or, roughly, one and two-fifths tussocks per beast per week. Allowing 1 cwt. of green material per plant, each animal will consume 160 lb of green material per week in addition to that obtained from the pasture run-off. Under the conditions obtaining at Waitakaruru (latitude 37° south), this amount of supplementary fooder appears sufficient to maintain stock in good healthy condition. In more rigorous climates one would expect a greater consumption to be required to produce the same results. The method by which the cow with its soft mouth is able to demolish and graze these tall sedge-like growths varies with the individual. Some animals favour pulling the canes from the base while others take hold of the leaves almost at the tips. Either method

appears to be equally easy to stock and causes them no inconvenience whatever. Next year there will be available on this farm from 8 to 10 acres of pampas, some of which will be reserved for an experiment in summer feeding.

The proper time to plant pampas is at the beginning of spring or after the worst of the frosts are over (see Fig. 3). Frost undoubtedly cuts back an inch or two of the tender young growth, but not sufficient to do material harm to the plant. New plants are obtained by subdivision of old matured clumps into single shoots with just a little of the root attached. A sharp-edged spade makes a useful instrument for cutting out new plants from old tufts. No particular care or skill appears necessary in planting new areas so long as the right season is chosen. New plantations should be allowed to grow and develop until their second year from planting, after which they may be grazed regularly either in winter or summer as may be most expedient. Following the feeding-off in breaks the whole of the residue left by the stock, consisting of dry mounds of dead leaves is fired, which clears up all the wasted material tramped under foot and neglected by the stock and reduces the tufts to a reasonable size (see Fig. 2). Firing appears to favour the subsequent development of a more luxuriant growth which may be partly explained by the fertilizing effect of the ash. Mr. McClean's methods and stock were carefully examined by Mr. C R. Taylor, from whom and from the owner himself the writer derives his information, and could find nothing to which he could take exception. Mr. McClean's revolutionary practice is certainly giving excellent results at present, and there is not the slightest evidence that might indicate any ill effects to the cattle from grazing as a supplementary fodder such an apparently rank material as pampas grass. The fibre is very short in the grain and the leaves readily break up into the smallest pieces.

Perhaps the feeding of pampas may be extended to cover supplementary requirements of early spring when stock tend to scour, for which it is an antidote if similar in action to toetoe (Goldie), and late summer when the pasture tends to be overloaded with clovers and therefore requires balancing with a diet less rich in protein and still palatable, which pampas certainly is. The feeding of excess of protein is wasteful and, some authorities hold, injurious (see this *Journal*, February, 1929, p. 97).

Droughty summers are not unknown in the North Island dairying districts, when the pastures dry up and the cattle suffer. It is easy to see that such a drought-resistant grass as pampas is likely to be a good insurance against the ill effects of food-shortage on a valuable herd at a time when other supplementary fodder is not available.

Conclusions.

Pampas grass grows at the rate of a foot or more a month from the divided root-stocks when planted out in the paddocks, and one thousand plants may be set in an acre of ground. In from eighteen months to two years these plants may be fed off in breaks which yield 50 tons of green matter to the acre. Cattle are very fond of the plants in their second year, and even ordinary grade cows improve in condition and give an increased butterfat test immediately they commence grazing this new fodder, the rise in the test being as much as 0·3 per cent., which

is lost if the cows are taken off the pampas. Cows remaining on pasture as a control show no increase. This is the result of two years' experience. Pampas tussock, if to be used for grazing, should not be fed off later than the second year; if left until the third year, although better for shelter, they are more difficult to graze. After the first year's grazing the tussocks may be grazed regularly every year. After the plantation is eaten down it is cleaned up by fire to destroy the dead rubbish. In a few days may be seen emerging from the charred remains of the pampas tussock many green shoots which grow so rapidly that in six months they may reach 7 ft. in height.

Compared with ordinary pasture grass, which has 75 per cent., pampas only contains 70 per cent. of water, while turnips contain 90 per cent. Hence pampas is rich in dry matter compared with other green fodders.

Mr. C. R. Taylor in going through the pumice country has taken the opportunity of inspecting shelter-belts of pampas, and finds them regularly grazed every winter by stock leaving good pasture to do so. He concludes that pampas has an economic value hitherto undreamed of and a definite place in every farm in the future.

The difficulty of providing winter feed on a bush section where there is no ploughable land may possibly be overcome by the use of pampas.

MANAGEMENT AND FEEDING OF THE DAIRY HERD DURING THE WINTER MONTHS.*

J. E. McIlwaine, Acting District Superintendent, Live-stock Division, Department of Agriculture, Wellington.

The customary autumn decrease in the milk-yield is due to several factors. In the first place, as the growth decreases in the paddocks so does the food-supply which acts as the stimulant to milk-production. During the late autumn, and more especially during the winter months, grass-production is at its lowest. The growth that has been left over from the previous spring and summer tends to become dry and fibrous and loses its high feeding-properties. The young leafy pasture, which is so nutritious for the production of milk, has to a great extent been eaten down and is not replaced during these months. This fact, together with the natural tendency to the cessation of milk-production as the dairy cow becomes advanced in pregnancy, accounts for the gradual drying-off of the herd. This period of rest for the dairy cow is very beneficial for the animal, provided reasonable care and attendance is bestowed. The rest period allows the animal time to build up her system which has been subject to a strain of heavy depletion. In young animals the rest period also allows a space for growth and further development of all parts of the body. In all animals a rest period of at least two months should be allowed if the constitution of the animal is to be maintained.

* Substance of an address broadcast from Radio Station 2YA, Wellington, April, 1934.

As the season comes to a close, those animals which are not considered a profitable proposition are culled and removed from the herd, being disposed of to the best advantage. Culling may be necessary for many reasons. It may be necessary to reduce on account of a shortage of winter feed the number of stock carried during the winter months. At this stage, from the point of view of good animal husbandry, it is better to reduce the numbers in the herd during the winter and feed the remaining stock in a reasonable manner than overstock and partly starve all members of the herd. Such alternatives as the removal of dry stock and young stock to other grazing to conserve the feed remaining is often considered by the dairy-farmer. Young stock and dry stock as a rule do fairly well on a good paddock of roughage, provided there is plenty of roughage and reasonable shelter. In the provision of this roughage it is advisable to see that the paddock does not contain tall fescue or other ergotized pasture. A few seasons ago visits to farms where cows were affected with ergot poisoning illustrated the need for care in this matter. One farm was in the Wairarapa district and the other farm was in Marlborough On both farms the supply of winter feed was used up, and in each case the cattle were moved to pasture in a paddock where the tall fescue had been allowed to get away and where it was very badly affected with ergot. As a result, several cows on each farm were severely affected with ergot poisoning, with the characteristic lesions of this complaint. It was found necessary to destroy several animals as recovery was out of the question.

Culling generally takes place at the end of the milking season. If herd-testing has been carried out, the natural thing to do is to remove the cows which are unprofitable The good cows are kept even though they have lost a quarter, as their value from a breeding point of view must be taken into consideration It is necessary to cull animals on account of disease. Cows that have been affected with mammitis in one or more quarters of the udder are not good animals to retain, as the tendency is for this trouble to recur in the following season. An animal affected with tuberculosis must be removed from the herd. Shy-breeding stock and stock affected with other defects should be removed. Probably the main cause of culling on many farms is the prevalence of udder trouble in some form or other. With culling and the removal of undesirable animals, accompanied by careful attention in drying-off cows, a reasonably healthy herd should remain.

It should not be necessary to state that the drying-off of dairy cows is very important so far as the preservation of the udder in a healthy condition is concerned. The usual practice adopted is to milk cows once daily when the cows go down in their yield. This procedure is carried on for a week and following this the intervals between milking lengthened. When milking has been finally stopped it is advisable to inspect the herd carefully a few days later to see that no udder is filling up again and requiring further attention. The leaving of milk in the udder of a dry cow is a frequent cause of mammitis the following season, and too much care cannot be taken in regard to this matter.

Occasionally an animal will be found which is very difficult to dry off. This may be due to the inherent milking-qualities of the animal or may be due to a liberal food-supply. In such a case the food-supply should be cut down, a laxative dose of medicine should be given, the intervals between milking should be gradually increased, and an astringent lotion such as alum may be applied to the udder.

At this season of the year farmers will be encountering cases of abortion in their herds. Young heifers with their first calves are liable to this disease on infected farms. When cases of abortion occur it is advisable to isolate the animals, to bury or burn all discharges, and to take measures to prevent the spread of the infection on the farm. Whether an affected heifer will be worth milking will depend on the date at which abortion takes place. A heifer or cow affected with this trouble should be attended to by the provision of shelter, a rug, by medicine, or by douching in order to prevent complications and to ensure the animal remaining in good health.

Cases of abortion at times are caused by rough handling. Hence heifers should not be hunted by dogs, be bustled into and out of yards and gateways, and the same remarks apply to the dairy herd in general at this season Careful handling of dairy stock is at all times advisable, special care being necessary from autumn onwards

The food-supply of the herd during the winter months is an important factor in the maintenance of health and good condition. Dairy cows require to be well provided for even during the dry months. Cows should not be allowed to fall away in condition as, if they do, good results cannot be expected next season A cow should be in good condition at calving-time, not necessarily fat, but with something to spare, as the drain is heavy until the spring feed comes away. With a herd in good condition at calving-time the peak of production is reached a few weeks after calving, whereas with a herd in poor condition the peak is not reached until the spring is well advanced. Moreover, the amount of trouble experienced at calving-time will be considerably reduced in those herds which have been well fed and well cared for. The shepherd finds it necessary to go round his flock last thing at night and first thing in the morning during the lambing season. The dairy-farmer must do likewise to ensure that everything is satisfactory.

The food-supply for the winter may consist of some roughage, which may be hay and roots and it may be silage or a combination of these staple foodstuffs. Whatever it is, it is advisable to see that the stock get an adequate daily allowance of a wholesome nutritious supply. When hay is being fed in fairly large quantities daily it is necessary to see that the water-supply is plentiful. Hay should be fed out in racks in preference to being spread out in the paddocks. The rack method is more economical and the hay is not trampled down and soiled. Hay of good quality is highly digestible and nutritious ; poorly saved hay, on the other hand, has a low food-value and is liable to cause indigestion and impaction. It is therefore advisable when feeding poor-quality hay to combine some roots in the daily ration, to see that a plentiful supply of water is available, and to provide a lick of agricultural salt. When hay of

low quality is being stacked or baled it is a sound practice to sprinkle the layers with agricultural salt. It improves the keeping-qualities of the hay and renders it more digestible.

Where roots, hay, and ensilage are available the common practice is to feed off the soft turnips with hay in the early part of the season, leaving the silage and the swedes and mangels till later in the season. The soft turnips will not keep, whereas the silage will keep almost indefinitely. It is always advisable to feed some hay with the roots. Large quantities of roots by themselves are liable to cause indigestion and scours and may lead to dysentery and "red-water." A better balanced ration is obtained when hay and roots are combined.

Mangels, unless fully mature, require to be pulled, stacked, or pitted some weeks before being fed out to stock. This procedure increases the sugar content of this crop and prevents the possibility of scours, which are frequently seen when the crop is fed immediately after being pulled. Although all roots contain a very high percentage of water they are much valued by stock-owners who prepare animals for show and sale. Roots contain a small percentage of dry matter which is highly digestible, the percentage of fibre being low. They have been described as watery concentrates.

Silage is being used more and more throughout the dairying districts as the mainstay of the herd during the winter months and during other periods of scarcity. Grass silage is the crop most favoured in New Zealand, and is as popular in this country as corn silage is in the United States of America. Silage has many advantages over hay and roots as a winter food-supply for the herd. Surplus spring growth can be converted into silage much more satisfactorily than into hay in a rainy season. There is not the same risk of deterioration and wastage when making silage. In regard to roots, the chance of a good crop in this respect depends upon several factors; in fact, in some districts it is a relatively difficult matter to grow a good crop of roots. Silage can be prepared in any district with reasonable conditions for the growth of pasture.

As a foodstuff for the dairy herd during the winter months silage is extensively used. It is succulent and nutritious and a very useful ration for dry cows or cows in milk. Properly conserved, it is rich in minerals, a necessary food constituent for a pregnant animal or a producing animal. The feeding-value of silage for milk-production is high: $2\frac{1}{2}$ lb. of silage are superior to 1 lb. of meadow hay. In a trial in a dairy herd where silage was used to replace both hay and roots it was found that $8\frac{1}{2}$ lb. of silage had a higher feeding-value than 10 lb. of mangels and 1 lb. of hay. Some of the protein in silage is in the partly digested amino-acid stage. Stock do very well on silage, give a good return, and retain their bloom.

The question of the mineral content of stock-foods has been receiving more and more attention of late years. It is opportune here to say a few words about the mineral content of the winter foods discussed above. In regard to the mineral content of silage, the mineral content of the grass crop can be conserved in the silage when the silage is made in dry weather. Some drainage may take place under other circumstances, but, generally speaking, silage is rich in its mineral content. Its mineral content can be increased by the inclusion of high-class plants such as the clovers and lucerne. Likewise, the mineral content of good quality

clover or lucerne hay is high. Hay which has been cut too late in the season, or hay which has been leached or subjected to rain is low in mineral content. Roots are low in their mineral content. Where low-quality fodders are being fed, both the protein and mineral content of such fodders are low. It may therefore be advisable to supplement the winter foods in use on many farms by the addition of a mineral lick. Agricultural salt should be provided for all dairy stock on all farms during the winter months. This can be added to by the addition of 25 to 50 per cent. of bone-meal or bone-flour. The addition will provide calcium and phosphorus, two minerals specially required by dairy cows even when dry, and more particularly required by dairy cows which are being milked through the winter months.

It has been shown that the dairy cow depletes her mineral reserves throughout the milking-season. The dry period is then a suitable time to build up again. There is some evidence to show that such diseases as tuberculosis, contagious abortion, and sterility are in some cases more apt to occur in herds where the mineral-supply is low.

NOTES ON RECENTLY OBSERVED EXOTIC WEEDS.

H. H. ALLAN, Plant Research Station, Palmerston North

(8) Horse Nettle and Buffalo Bur.

THESE objectionable relatives of the potato belong to the same genus (*Solanum*) and have similar flower and fruit structure, but belong to the section bearing stout prickles on the stems and leaves. Another distinguishing feature is the presence of branched hairs, the branches arranged in a rayed fashion (stellate). Both are considered to be poisonous, but it is very rare for stock of any kind to touch them, though sheep have been known to nibble at the fruits of the horse nettle. The solanums are readily recognized in flower by the five long anthers, which are usually closely placed round the style, and which open by pores at the tips to release the pollen. The berry or "apple" is two-celled with numerous seeds. Another member of this prickly section of the genus is the apple of Sodom (*S. sodomaeum*). This was first noted in New Zealand about 1882, and is now found throughout the Auckland Province, favouring light dry soils and waste places. It is briefly described here for comparison.

The following key may assist in identification :—

1. Flower yellow, fruit covered by the prickly calyx	*S. rostratum.*
Flower purplish or violet, fruit extending beyond the calyx as an "apple"	2.
2. Plant shrubby, fruit about $1\frac{1}{4}$ in. across ..	*S. sodomaeum.*
Plant with far-creeping roots, herbaceous, fruits about $\frac{1}{2}$ in. to $\frac{3}{4}$ in. across	*S. carolinense.*

HORSE NETTLE—*Solanum carolinense* (FIG. 1).

An herbaceous plant, becoming more or less woody at the base of the stems, with a deep root-system. Spreads by means of horizontal

roots, which may extend to 3 ft. through the soil and send up shoots at intervals. Stems 1 ft. to 2 ft. tall, more or less straggling, and bearing, as do the leaves, numerous stellate hairs, with four to eight

FIG. 1. HORSE NETTLE, SPECIMEN FROM TE PUKE.

rays. The stems, mid-ribs, and sometimes other veins of the leaves are armed with stoutish yellow prickles. The leaves are from 2 in. to 4 in. long, more shallowly lobed than in the other two species, and rather greener in colour, with usually a more pointed tip. The calyx

has slender teeth, and bears few or no prickles. The corolla varies from violet to light blue or white and resembles that of the potato. The berries are from ½ in. to ⅜ in. across, orange-yellow when ripe, with a disagreeable odour.

FIG. 2. BUFFALO BUR, SPECIMEN FROM WHANGAMOMONA.

This species is a native of the Southern States of North America, but has extended its range, and in Iowa especially has become a bad pest. It is a perennial, and its root-system makes it difficult to cope

with once it has become established. American authorities recommend frequent cultivation of infested areas to weaken the plant, followed by a smother crop. Sudan grass, sorghum, vetches, rye, and other quick-growing crops capable of providing a dense cover are used. In bad cases this treatment has to be applied for two or three seasons. Small patches may be killed outright by the use of hot brine, caustic soda, or kerosene. Sodium chlorate in the ordinary strengths has not proved successful, apparently not checking the root-growth sufficiently.

Horse nettle has recently been sent in by Mr. C. Walker from Te Puke, where it has become aggressive in one paddock. Prompt action may prevent its spreading further.

FIG. 3. APPLE OF SODOM, SPECIMEN FROM AUCKLAND

BUFFALO BUR—*S. rostratum* (FIG. 2).

This is more erect than horse nettle, and lacks the extensive root-system. It is usually more yellowish in appearance, owing to the greater development of stellar hairs. The prickles also are more numerous and rather stouter. The leaves are rather melon-like in shape, much more deeply lobed than in horse nettle, and with narrower segments. The tip is more rounded. The calyx teeth are sharply pointed and the corolla is yellow. One anther is much larger than the other four, with an incurved beak (hence the name *rostratum*). The berry remains enclosed when ripe in the very prickly calyx.

This is a native of the plains region between the Missouri River and the Rocky Mountains, but has also greatly extended its range. It is the original host of the potato-beetle. As it is an annual, remedial

treatment is simpler if taken in hand in time. The aim should be to prevent seeding by frequent cutting of the plants. If fruits have already formed the cut plants should be burnt.

FIG 4. APPLE OF SODOM.

Illustration from "The Weeds, Poison Plants, and Naturalized Aliens of Victoria," by A. J. Ewart and J. R. Tovey (Melbourne, Government Printer).

This weed was observed by Mr. E. A. Madden at Whangamomona, but in very small quantity. A lookout should be kept for stray plants, as a few neglected plants would soon provide a rich harvest of seed.

APPLE OF SODOM—*S. sodomaeum* (FIG. 3).

This is a spreading shrub up to 3 ft. tall. The leaves (Fig. 4) are deeply lobed, the lobes broader and more rounded than in buffalo bur. They are from 3 in. to 6 in. long. The calyx teeth are blunt, and the corolla purplish to violet. The berries are variegated green and white, becoming yellow when ripe, and reaching an inch or more across.

It is a native of the Mediterranean, and has been naturalized in Australia for many years, where it has given much trouble. It is a perennial, but succumbs to repeated cutting. Australian experience is that two or three cuttings a year soon exhaust it.

CONTROL OF CELERY-SPOT DISEASE.

J. C. NEILL, Field Mycologist, Plant Research Station, Palmerston North.

CELERY-SPOT disease, commonly called "rust," is the greatest enemy to successful production of celery. An account of the disease and its control appeared in this *Journal*, Vol. 26, p. 289, May, 1933. In this article successful control of the disease was claimed, "subject to confirmation by further experiments next season," by a seed-treatment combined with certain sanitary precautions. The treatment consisted in dipping the seed for ten minutes in water held at 136° F. During the past season a line of heavily infected celery-seed of the "White Plume" variety was treated by this method, grown under glass at the Plant Research Station, and the resultant plants distributed to eleven gardeners at widely separated parts of the district. Of these plantings only one developed celery-spot, this being in a town garden in which severely infected plants had been present during the preceding season. A control sowing of the same seed untreated developed early and severe infection.

It appears, then, that the method can be relied on to produce plants which are free from the disease, and which will remain free if reasonable precautions are taken to avoid infection from previous or contemporary infected celery-plants.

RUSSET ON APPLES.

N. J. ADAMSON, Orchard Instructor, Hastings.

ONE class of russeting commonly produced on apples and considered to be due to many causes has its origin in frost injury. Apples which have been damaged by frost in the early stages of development are readily recognized by a flattening of the calyx end. It has been observed that in frost-affected areas many injured fruits which have continued to grow, carry a heavy russet around the calyx.

Although in many instances there may be a degree of russeting, with no apparent frost injury, as indicated by a flattening of the

fruit, the heavy type of russet damage around the calyx is confined to fruits which have been more severely frost-injured and which show damage in the flesh.

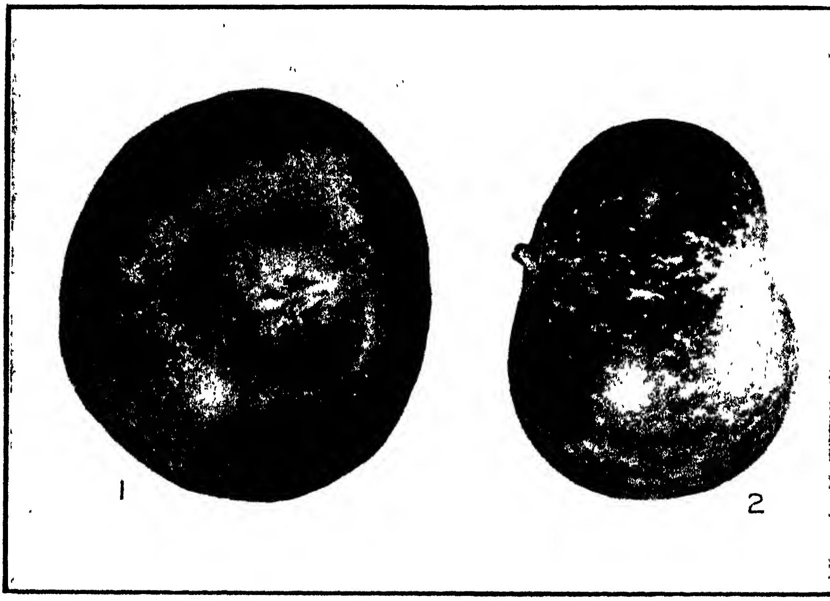

FIG. 1. RUSSETING OF THE FRUIT DUE TO FROST. FIG. 2. FLATTENING OF THE CALYX END CAUSED BY FROST.

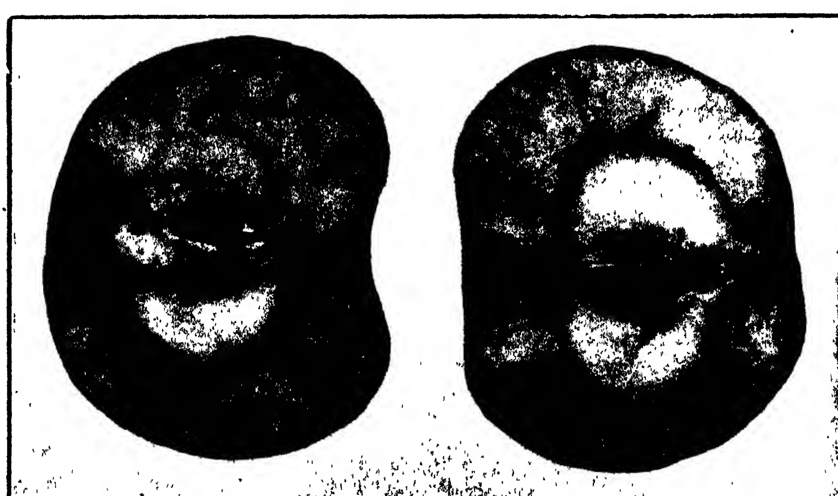

FIG 3. INJURY TO THE FLESH WHICH HAS FOLLOWED.

[Photos by H. Drake.

The illustrations show the characteristic russeting on frost-injured fruit, the flattening of the calyx end of the apple, and the injury to the flesh which has followed.

PASTURE MANAGEMENT: GOOD "CONTROL" OF PASTURES IS NOT NECESSARILY GOOD "MANAGEMENT."

A. W Hudson, Crop Experimentalist, Plant Research Station, Palmerston North.

THE object of this article is to marshal and present a few facts regarding the utilization of pasture herbage and their bearing on production, more particularly on sheep-farms on our medium- to better-class lowland sheep-country.

It has been amply demonstrated that under similar conditions of closeness of grazing the more frequently a pasture is grazed or cut the lower will be its production, or, conversely, the longer the spelling periods between grazings the greater will be the production.

The mention of spelling periods implies intermittent grazing and spelling or what is commonly called "rotational grazing." It is a comparison of this system with that of a "set rate of stocking," which is the more commonly practised one on sheep-farms, having for their object the production of fat lambs, that the writer desires to focus attention on.

Evidence in support of the statement regarding frequency of grazing is abundant, and a few examples provided by research work in Britain, Australia, and New Zealand will be drawn on for its substantiation.

As a result of cutting pastures at varying intervals Woodman and co-workers (1, 2, and 3) at Cambridge, England, obtained the following results. In 1927 pasture cut at fortnightly intervals yielded 10 per cent. more dry matter than when cut at weekly intervals. In 1928 fortnightly cutting resulted in an increased production of dry matter of 29 per cent. over weekly cutting, and three-weekly cutting in 62-per-cent. increase over weekly. In 1929 and 1930 the comparison was extended to one of monthly versus weekly cuttings. In each of these seasons monthly cuts yielded 45 per cent. more dry matter than weekly cuts.

The above does not mean that three-weekly cutting caused a greater increase over weekly cutting than monthly cutting did. The monthly cutting, although carried on on the same pasture as the three-weekly, was done in different seasons. The vagaries of climate, no doubt, influenced the magnitudes of the superiority of three-weekly and monthly respectively over weekly cutting.

That the influence of severity of cutting or grazing in one year may be reflected on production in the following year has been demonstrated by Stapledon(4) on, amongst others, a dense pasture of cocksfoot.

Treatment in 1922.	Relative Yields from Eight Cuts in 1933.
(1) One hay crop and two aftermath cuts	100
(2) Cut monthly (ten cuts)	94
(3) Cut fortnightly (twenty cuts)	61

Again, at Aberystwyth, Jones and Jones(5) found that a pasture subjected to different periods of spelling between grazings gave appreciably different amounts of live-weight increase per acre from lambs grazed thereon.

With monthly resting periods 175 lb. live-weight increases per acre were obtained against 167 lb. and 132 lb. for fortnightly and four-days resting period respectively. In other words, the live-weight increases were 26 per cent. and 32 per cent. greater with fortnightly and monthly spells between grazings respectively than with four-day spelling periods.

At the Imperial Chemical Industries' Agricultural Experiment Station, Jealott's Hill, M. G. Jones(6) compared the effect of close and frequent cutting or heavy grazing on the one hand with cutting less frequently and severely or grazing lightly on the other hand, on root development. The comparison was made on five different types of swards, with the result that on the average there was a 63 per cent. greater weight of roots to a depth of 6 in. on the less frequently cut or less severely grazed portions than on the more severely treated ones.

In South Australia Richardson(7) compared monthly cutting with cutting at two-monthly intervals on an irrigated pasture, with the result that over a period of one year the two-monthly cutting gave a yield 28 per cent. greater than monthly cutting did.

At Lincoln College in Canterbury(8) the carrying-capacity under a system of "intensive" (rotational) grazing was compared with the carrying under "extensive" (set rate of stocking) grazing. Over a period of two seasons 6·8 sheep per acre were carried on the intensively grazed area against 3·8 sheep per acre under extensive grazing.

In an investigation carried out at the Marton Experimental Farm(9), 1929 to 1932, cutting pasture at a "sheep-grazing" stage was compared with cutting at a "cattle-grazing" stage. Intervals between cuts ranged from five to seventy-four days when cut at sheep-grazing stage and from twelve to ninety-nine days at the cattle stage, depending on the time of the year. The less frequent cutting resulted in 10 per cent. greater production of the green herbage than the more frequent cutting.

Other examples of the effect of frequency or severity of defoliation on production could be quoted, but those given should be sufficiently convincing.

In every case, and the writer has seen no exceptions recorded, the less frequent cutting or grazing has resulted in greater production of herbage, greater carrying of stock, or greater root-development, as the case may be, than more frequent cutting or grazing.

It should be noted that in the cases quoted where cutting has been carried out the most frequent defoliation occurred at weekly intervals. I would regard this relatively severe defoliation as very lenient, compared with that taking place on our sheep-farms, especially in the early spring months. Where the stock are spread over practically the whole of the available grassland they are consuming the herbage as fast as it grows. Virtually, during the early spring months of August and September and at times when growth is even slower than in these months they are doing what Mr. Cockayne has aptly described as "eating day-old grass." It is obvious from the results quoted that the mere fact of keeping the pastures continuously short is in itself limiting their capacity to produce: hence the title of this article "Good 'Control' of Pastures is not necessarily Good 'Management'." The leaf is as essential to the well-being of a plant as the root, and the

capacity to produce is governed to a considerable extent by the amount of leaf which a pasture plant is permitted to produce before it is consumed by stock.

If, instead of continuous defoliation at times when rate of production is below the consumption-capacity of stock, a system of intermittent grazing and spelling is adopted an appreciable increase in production of herbage must result. This can be achieved by rotational grazing. That such a system is practicable and productive of outstanding results is borne out by the evidence presented in an article by McCulloch and Connell in the current issue of the *Journal.*

Just what lengths the resting periods between grazings and the ntensity of stocking should be must be governed by circumstances. Although long spells of three or four weeks will result in greater production than if one-week resting-periods are adopted, it is obvious to any one who has attempted intensive grazing with sheep that such lengthy periods would, under some circumstances, be productive of disastrous results

When grass growth is prolific on good land and the climate wet, a resting-period of more than one week may mean a growth such that when the pasture is heavily stocked a large amount of soiling with consequent waste of herbage will result, to the detriment of stock. Under dry soil and climatic conditions or when growth is less rapid fortnightly or longer resting-periods may not be too long.

One must generalize, and say that, *under a system of rotational grazing, pastures should be spelled for as long a period as possible between grazings commensurate with good utilization by the stock employed* Good utilization will almost certainly mean good thrift in stock, but good utilization does not mean severe and extremely close grazing which may offset the advantages of spelling. Sound common-sense and a knowledge of local conditions are necessary for the most effective application of the principles embodied in good pasture management.

If the evidence presented which serves to indicate in some measure at least one of the reasons for high carrying-capacity on the farm described by McCulloch and Connell only gives the "set rate of stocking" advocates food for thought, the writer feels that some good at least must eventuate

To those who say that lambs will be mismothered and cannot be fattened under rotational grazing, that intensive stocking with sheep will result in an undue amount of disease, or have any other real or imaginary objections, it is suggested that they read the article by McCulloch and Connell on what has been achieved by a Marton farmer.

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SEASONAL NOTES.

THE FARM.

Planning of Field Work desirable.

AT this time of the year the planning of future farm operations may very fittingly be carried out That it is a task of major importance seems often to be disregarded, yet it has been well established by experience that in farming the greatest reward has gone to those whose operations are best planned, who plan their operations well in advance, and adjust their farming to suit the needs of the times. Never was there greater need for efficiency of farm production The wide differences in the general efficiency of farmers arise largely from differences in the efficiency of their planning There is every reason to expect that rewards in farming will continue to correspond with efficiency

One matter worthy of consideration in planning is that sound farm management involves the distribution of labour requirements in such a way that the idle days at one period and the overcrowded days at other periods are both avoided as far as possible The approach of the relatively slack period in the year of many farmers makes it seasonable to consider how any rush and bustle in spring and summer may be reduced by attending in the slack period to such jobs as fencing, the construction of ensilage pits and trenches, the repair or adjustment of equipment, including farm machinery, and the preparatory work in the production of special crops for use in periods of scant growth of pastures

One of the strong reasons for the prolonged adherence to traditional systems of rotational cropping was that they provided for full and economical use of all farm labour throughout the year and obviated either a rush of work or a slack period New Zealand farmers commonly have adopted the economically sound course of cropping on the basis of market prospects instead of conforming strictly to any specific systems of rotational cropping Although it has at times been advisable to forgo some of the advantages of rotational cropping, it is well to bear in mind that rotational cropping has considerable academic merit which should be exploited if at all practicable

Planning according to Needs of all Stock.

A matter of primary importance in the planning of cropping is the needs of all the stock at different periods throughout the year. Judging by results, it would seem that often the provision of feed is based on the requirements of the class of stock of major importance, while those of stock of less but of considerable potential importance are ignored For instance, on North Island dairy-farms the cropping often seems to make little or no provision for pigs and poultry, and similarly on South Island mixed farms on which grain and sheep are dominant the needs of small dairy herds and of pigs are ignored : this, in both Islands, with consequent substantial detriment to the total returns

Bearing of "Twitchy" Weeds on Planning.

Another matter which requires to be taken into consideration in planning cropping is the suitability of the soil and climate for particular crops In this the weed population of the ground is of moment. For instance, an old pasture which is to be broken up this season should, if "twitchy" be utilized in a different manner from an old pasture which is not "twitchy." The latter, with success, may be skim-ploughed in the winter,

worked, and then deep-ploughed in the spring, and sown in a spring or summer crop such as lucerne, mangels, potatoes, peas, rape, turnips, or barley. But if the old pasture is twitchy, if possible it should not be broken up in the winter or spring, but left till mid-summer. Then, in December or January, it may be broken to a depth of 2 in. or 3 in., cultivated till February or early March, and then ploughed deeply—to a depth of 7 in. or 8 in if possible. In this ploughing it is well to employ a skim-coulter to assist in burying as completely and deeply as possible all portions of the twitch Alternatively, one deep ploughing in summer, also with a skim-coulter utilized, may be employed. In either case subsequent cultivation should be of such a nature that it will not bring portions of the twitch to the surface again Further, the cropping should be planned so that the weakening of the twitch which was started by the summer tillage will be continued by the "smothering" effect of dense, vigorous crops, the first of which should be sown in the autumn For this purpose oats and tares are practically ideal, provided good cultivation is associated with liberal manuring so as to result in a heavy crop which will "smother" effectively the twitch in the spring. An autumn-sown temporary pasture of Italian rye-grass and red clover or an autumn-sown crop of Algerian oats is also serviceable. As far as possible, such crops usually should be followed by another leafy shading crop to complete the suppression of any twitch that remains Other fairly satisfactory shading crops are peas and rape The essential features of twitch control are—(1) preliminary surface summer cultivation to weaken the twitch, especially if the climate is dry enough to facilitate the weakening process; (2) deep and thorough burial of the remnants of the twitch, and (3) smothering by dense cropping.

The method of twitch-control is of importance apart from the treatment of land infested with twitchy grasses, for it embodies a general principle which should come into operation, in methods suitably modified, for dealing with such weeds as sorrel, blackberry, yarrow, tall fescue, and Californian thistle The economic control of such weeds should be based not on direct attack through cultivation, such as is given by relatively extensive summer fallowing, but on a system of cropping which will pay for itself and which often may well contain as a valuable initial step suitable summer cultivation.

Annual Weeds call for Consideration.

Another aspect of weed infestation should be considered when future cropping is being planned. It is concerned with annual weeds such as fathen, spurrey (yarr), nightshade, and willow-weed, which often germinate in the spring instead of at other times. Crops to occupy land known to be infested with such weeds should be sown in the autumn rather than in the spring The influence on weed-control of the date of sowing is often well illustrated when wheat is sown on land infested with fat-hen seeds While the fat-hen is likely to compete strongly with the spring-sown wheat and thereby lessen the returns, it is unlikely to be much in evidence in the autumn-sown wheat. There is likely to be similar differences in the intensity of spurrey invasion of spring-sown and of autumn-sown crops. It should be borne in mind that the avoidance of trouble from annual weeds for one season in the manner just described by no means frees the land from weed-seeds: the seeds of many weeds, including fat-hen and spurrey, are capable of remaining in the ground alive and vigorous for many years. Because of this, land heavily infested with such weeds should, when possible, be sown in pasture which—provided the pasture continues satisfactory—should not be ploughed under until this is necessitated by circumstances.

In planning the cropping programme for the coming season another matter which should be given consideration is the fact that the production

of high-yielding mangel, carrot, potato, and lucerne crops is made easier and more profitable if these crops are given the advantage not only of high fertility, but also of freedom from weeds. Often relatively high fertility may be secured by breaking up old pasture for these crops. Further, in respect to weeds, old pasture often possesses superiority, provided it is treated properly, and this even though the surface layer be heavily infested with weeds and weed-seeds. From the weed viewpoint, two deep ploughings which are at times recommended for the preparation of a seed-bed from old pastures constitute just one deep ploughing too many The first deep ploughing may put most of the weed-seeds at such a depth in the soil that they do not germinate, and hence cause no trouble so long as they are left in that position. But the second deep ploughing will bring them near enough to the surface again to lead to their germination and consequent trouble from them. Fortunately, often the necessary good seed-bed can be obtained without two deep ploughings– a skim ploughing in the winter followed by disking to pulverize the surface soil, and a deep ploughing in the spring may be employed to obtain a sufficiently good seed-bed. It has been pointed out above that this procedure would be unsatisfactory in the case of land infested with twitchy weeds, among which may be included not only twitchy grasses, but also other twitchy plants such as sorrel and yarrow. However, as a rule, the growing of such crops as carrots, potatoes, mangels, and lucerne should not be attempted on land infested with twitchy weeds.

Heavy Acre-yields commonly desirable.

In planning cropping, attention should be given to the fact that the use of more permanent strains of important pasture species, together with appropriate top-dressing, has given during recent times pastures which remain in a satisfactory condition for a longer period, if not permanently. This reduces the amount of land it is desirable to put under the plough annually for the purpose of replacing worn-out pastures. In turn, in many instances this will create a more urgent need than ever for greater yields to the acre in respect to such crops as mangels, chou moellier, roots, and rape. As a rule there will be no decrease in the total tonnage of such crops required, but it will be desirable to grow that tonnage on a smaller area.

The desirability of greater yields to the acre gives importance to the fact that generally in the case of crops that respond well to good treatment greater expenditure is justified on high-priced good land than at first sight might seem to be justified. The amount of increase in the crop decides whether the additional expenditure necessary to obtain the increase is justified Over many years the results of farmers' crop competitions have demonstrated that in the case of mangels, for instance, differences of from 20 tons to 30 tons an acre, and more, in yield are commonly due to additional manure and labour. An expenditure of £4 an acre would cover the cost of much additional manure and labour, and if it resulted in an increase of 20 tons an acre in yield the cost of the increase in yield would be 4s. a ton. How mangels at this cost compare with other feeds may be gauged from the fact that with oats at 1s. 6d a bushel, or barley at 2s 3d. a bushel, or oat-sheaf chaff at £2 10s. a ton, or hay at £2 3s. a ton, or pollard at £4 11s. a ton, then on the basis of their nutritive value mangels are worth from 8s. to 9s. 6d. a ton, according to their composition. Though in practice all the feeds specified are not interchangeable, the statement of their relative nutritive values in terms of cash values provides the basis for instructive comparisons. The important point illustrated by such a relatively low price for the increase in yield of mangels is that crops of heavy yields may readily provide comparatively cheap feed even though the outlay on such crops seems high.

In planning future cropping the incidence of crop diseases and pests in the past at times is of much moment. This is especially so in the case

of crops of the cabbage family, such as rape, turnips, and swedes. Incidentally, chou moellier is very resistant to, though not proof against, club-root, and has successfully followed another crop which has failed because of club-root attack. Potatoes also may become seriously infected through the unpicked tubers of previous diseased crops; and a limited amount of New Zealand experience supports the view that heart-rot in mangels is carried over in the soil from one crop to another. Previous grass-grub infestation should be considered, and, if possible, cereals and pastures infested by the grub should not be followed immediately by similar crops.

Pasture Management.

Normally in June the completion of grassland work commenced earlier calls for attention; part of the harrowing and top-dressing may remain to be done. These operations were discussed in some detail in the March and April notes

On most farms there are certain grass paddocks which are more suitable than the remaining ones for providing late winter and early spring feed. Usually these are the paddocks which are well drained, supporting a sward containing a considerable amount of rye-grass, and possibly also provided with some shelter. Such paddocks especially should be harrowed if necessary and top-dressed in good time, for, in many districts, if they are shut up about the end of May or early in June they will provide a substantial amount of fresh feed in the latter part of July and in August.

If there is evidence of current infestation by grass-grub, then, when possible, hay and roots should be fed out on the infested areas: the additional stock-trampling and consolidation which results either lessens the activity of the grubs or facilitates the recovery of the injured plants, and the hay may contain viable seeds of valuable pasture species which on germinating tend to repair the ravages of the grubs

Crop Utilization.

On many farms the pulling and storing of mangels should receive attention in June, particularly if the land occupied by the mangel is required for another crop, such as oats, to be sown soon. However, general rules about the pulling of mangels are unreliable. In certain districts the crops will continue growing in weight well beyond the date fixed by some as that at which pulling should be carried out. It is very doubtful whether it is advisable to pull such crops early in June if they are not to be used until late August or September, unless the land they occupy is specially required for some other crop or likely to become so wet later that it will be difficult to cart the crop off. However, if the crop is to be fed to stock earlier than has been mentioned above, then it should be pulled in good time to allow it to ripen or mature before the stock consume it. Freshly pulled mangels cannot stand frost as well as those still in the ground or those that have been pulled for a few days. Hence, if at all possible, in order to avoid frost injury, broken mild weather should be selected for the work of pulling. Many sheep-farmers successfully utilize mangels relatively late in the season without storing them. If broken-mouthed ewes are available they are put in to eat off the tops; then the roots are harrowed out in breaks some days prior to the sheep being given access to them.

If the mangels are to be pitted, the practice of throwing the roots into small heaps, covering the heaps with leaves removed from the roots, and leaving them for a few days before carting is favoured by some: it is believed that the roots keep better by being left in a heap for upwards of a week before carting into the pit.

Ordinarily it is not advisable to allow stock to fall off much in condition before a commencement is made with the utilization of reserves of

such feed as roots, hay, and silage. It is desirable to plan on the possibility of having to provide for a late severe spring, but such planning should lead to adequate provision being made at the appropriate season, and, at this stage, looking to the future may be carried too far at the expense of the current requirements of the stock.

The winter feeding of stock on roots alone is undesirable. Stock so fed receive a diet which is much too watery and cold for ordinary requirements, and which is likely to set up digestive disturbances. Heavy root feeding is particularly unsuitable for old, toothless ewes if the roots are offered intact Heavy root feeding to any type of breeding-ewe or to dairy cattle is also inadvisable. Roots may suitably be supplemented with dry fodder such as hay or chaff The quantities of each class of feed to be used depend to a considerable extent on such circumstances as the supplies available and how much feed the stock can obtain from the pastures on which they may be running Detailed information applicable to individual cases may be obtained on application to district officers of the Department of Agriculture.

--R P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Laying out the Ground for planting.

AFTER the site for the new plantation has been thoroughly drained and cultivated as directed in last month's notes, it should be marked off, and before the holes are dug the position each tree is to occupy indicated by a stake The question of adequate headlands on which to turn implements, horses, &c , must not be overlooked It is suggested that a headland of about 20 ft be left all round the plantation for this purpose. Each tree should be allowed sufficient space for proper development On rich soil trees of normal stature usually should be planted 20 ft apart each way, and trees of tall and spreading habit planted 22 ft apart On poorer classes of soil plant the trees from 18 ft to 20 ft. apart

Cultivation and Manuring.

As soon as possible growers should put in hand the annual ploughing of the orchard, with a view to having the work completed as early as possible in June The soil in early June should be in reasonably good condition for ploughing The majority of fruit-trees will have shed their leaves by the end of May or early June and cover crops will have come to the flowering stage. Such manures as superphosphate and sulphate of potash are recommended to be sown just prior to this the deepest ploughing of the season. When turned under in conjunction with the green crop they will be deposited close to the roots of the trees. The freshly ploughed soil will receive the full benefit of the action of the winter frosts. The striking-out furrow should be thrown up against the trees, while the finishing furrow should come midway between the rows of trees In heavy land the finishing furrow will act as a temporary drain, and if carefully opened up will carry away practically all surface water. When ploughing, care should be taken not to injure the tree-roots more than is necessary, and to eliminate avoidable injury the plough should be set to a depth of about 3 in for the striking-out furrow and increased to a depth of 6 in. or 7 in for the finishing furrow.

Planting.

The holes for fruit-trees should be wide enough to permit of the spreading of the roots, and should be convex—*i.e* , of the shape of an inverted saucer—at the bottom. This shape is obtained by forming a slight

mound with loose surface soil in the bottom of the hole so that when the tree is planted its base stands a little higher than the roots, which should be spread out with a slight downward tendency A handful of bonedust or superphosphate well worked into the soil of each hole will assist in providing nutriment, thereby ensuring rapid growth of the tree The tree should be planted firmly, and at about the same depth as it was growing in the nursery—or possibly a little more deeply. The root system is usually damaged when being lifted from the nursery-bed. With a clean sharp pruning-knife or secateurs bruised and damaged roots should be cut back to sound tissue A clean cut will quickly callus over With a view to guarding against excessive drying of the roots, only a few trees should be removed from the "heeling-in" bed at a time. The actual planting operation is carried out by placing the tree on the slight mound in the hole —previously mentioned— and obtaining the position of the tree by taking an alignment at different directions on trees already planted or on stakes marking the position of unplanted trees When the correct position has been found, a small quantity of fine surface soil should be shovelled in and tamped gently round the roots. Each root should be firmly embedded in the soil. It often happens that the roots do not arise from the same level but occur spirally, each of the main roots being an inch or two above the one below, in which case it is very unwise to crowd them all together When all the roots have been covered over and well tamped, the remainder of the hole may be filled up and the soil trodden firmly round the tree, with the exception of a few final shovelfuls, which should be left untrodden The pruning should be delayed until the trees are planted Trees which are merely rods should be headed back to a point about 20 in. from the ground-level. On branched trees two years from the bud it is advisable to select three or four branches equidistantly spaced spirally around the upper portion of the trunk. The selection of branches directly opposite one another should be avoided, as weakly crotches will be formed Each of the branches retained should be cut back to about the fifth bud from the base, the two topmost buds preferably should be side buds if the branches are of normal vigour, so that the foundation branches may be duplicated and result in strong stocky trees. If it is necessary to retain weakly branches, these should not be duplicated this season, but should be cut to an outside bud, unless the branch is in an almost horizontal position, when an inside bud should be chosen for the top bud. Too-deep planting, insufficient pruning, deficient cultivation, and neglect to control diseases and pests will cause trees to be unthrifty.

Winter Pruning.

In those districts with a temperate climate it is not advisable to prune too early owing to the fact that a warm spell, which sometimes occurs in such districts, has the effect of exciting early pruned trees into premature growth which may be destroyed subsequently by frosts. Generally, however, particularly in large orchards, pruning should be commenced as soon as the trees are dormant, so as to allow sufficient time between the completion of the pruning and the commencement of the new season's growth for the sprays appropriate to be dormant season to be applied. Stone-fruits, being the first to start into growth, should be pruned before pip-fruits.

—*J. W. Whelan, Orchard Instructor, Palmerston North.*

Citrus-culture.

If much rain is experienced during the month of April, especially after the dry autumn this year, it will cause citrus trees to produce much young succulent growth, which will not have time to harden before the first frosts occur. In those localities where frosts are prevalent measures should be taken by growers to protect their trees. Details for the protection of the trees and their crops from frost injury were outlined in the *Journal* notes of May last year.

Heavy rains favour the spread and development of citrus brown-rot. To prevent the spread of this disease all branches on infected trees should be removed to a height of 3 ft. from the ground, infected fruits destroyed, and cultivation carried out to maintain a somewhat dry soil-mulch under the trees. Further, a cover crop, which will prevent the upward spread of the zoospores by means of water splashes, should be grown. If the foregoing recommendations are followed, growers should readily eliminate this disease from their orchards.

The time is now approaching when the harvesting of citrus fruits will be receiving attention. Lemons should be harvested as soon as the fruit has attained the necessary size, so as to prevent ripening beyond the silver or pale-yellow colour which is the most suitable stage for curing. Poorman oranges should not be gathered before they are fully matured, but for table use should be harvested while the flesh is tight and compact, so as to secure the maximum juice content.

Sweet oranges should be left on the tree until they are properly matured, so that they may develop their full flavour. Where new plantings are contemplated, the selecting and ordering of trees should be undertaken as early as possible. —*L. Paynter, Orchard Instructor, Auckland*

POULTRY-KEEPING.

Winter Eggs.

As the majority of the mature hens will, by now, have terminated their laying-season and will be undergoing the moulting process, it may be taken for granted that few hens will be profit-makers until the end of winter or the early spring, as it is rare for a bird to lay and moult at the same time. Hence, if eggs are to be secured in good numbers now, the pullet principally must be depended upon to produce them Having pullets on hand, however, and even those hatched at the desired period for winter laying, does not necessarily mean that a good egg-yield will be secured, as the stock is only one essential requirement At this period of the year, when natural conditions are all against the birds' laying, it is necessary to give the pullets the best possible attention in order that they may produce to their fullest capacity. This means that, as far as possible, summer conditions must be provided in order that the birds will be in a state of comfort at all times, and thus enjoy a healthy, thriving condition. When unfavourable weather prevails the birds should be kept inside the houses, where they are protected from the rain, cold, and wind The quarters must be roomy, not merely sufficient for the birds to roost in at night, but with ample space to accommodate them in comfort on a wet day. They must also be provided with an ample supply of good, nourishing food, for the pullet's life is a busy one, since the laying fowl produces a more concentrated and valuable food commodity for its size than any other domesticated animal It is also essential that exercise be encouraged, and this can be induced most effectively by having the floor covered with litter from 4 in. to 6 in. thick, in which the evening meal and grain is scattered. It is always a good plan to give a little more food at this meal than is required, so that the birds will have something to scratch for in the early morning and thus obtain the necessary exercise.

With regard to diet, there are many different rations that will produce good egg-yields. The main object is to see that the food is of good quality and fed in abundance. It is very inadvisable to feed musty or damaged grain because it is cheap. A frequent mistake is to think that all grain is alike, and that cheap defective wheat and low-grade oats, barley, &c.,

are economical The food-value of these is almost invariably in direct proportion to their cost, and it is generally the case that the best grades of grain materials are the cheapest in the long run, for, given all the greenstuff and meat required, the bird will be satisfied with a much smaller proportion of good-quality grain than it will with a cheap grade. The waste, also, is considerably less with the better-quality article. Cheap grain for poultry is false economy in the worst form, and quality rather than quantity should always be the deciding factor in a ration for the layer, especially where the winter-laying pullet is concerned. Many complaints have reached the writer regarding pullets bred to lay during the winter which have gone into a moult with a consequent poor egg-supply This undesirable moult may be due to several causes, such as insufficient or inferior food, change in the system of feeding, contracting colds, as well as the common cause—change of quarters.

The Fertile Egg.

The question has been asked whether it is not a sure sign, when an egg is broken into a saucer and a watery coloured substance is to be seen adhering to the edge of the yolk, that the egg had been fertilized The substance referred to is called the cholaze and can be seen in all eggs whether fertile or infertile The cholaze extends from the yolk through the white toward each end of the egg in twisted cord-like coils The cords may be likened to hammock-strings, in that they serve to hold in position the yolk, which is contained in a membrane of delicate construction, and yet allow it to turn freely The chicken does not come from the cholaze, as is generally supposed, but from the germinal disk, and this is found in the yolk of all eggs whether the hens which produced them have had the society of a male bird or not. The germ disk is circular in shape and about ⅛ in in diameter It varies in colour from light yellow to orange. The difference between a fertilized and an infertilized egg is to be found only in this small disk, which can be seen readily with the naked eye when an egg is broken into a saucer. Of course, when an egg is broken into a saucer, the germ disk will be found as often on the under side as on the top of the yolk.

Egg Classes at Shows.

The great weakness in the egg trade to-day, especially where the eggs come from mixed farmers, is the manner in which they are marketed The careless way in which many eggs are despatched to the consumer—*i e*, in a dirty state and in all sizes and conditions—is not only sufficient to prejudice the consuming public against eggs, but means a direct loss to producers, who cannot expect anything but second- and third-grade prices for such unpresentable commodities It is generally the case that the person who is careless about the appearance of his eggs is also careless regarding their internal condition. Some poultry societies in the Dominion endeavour by competition and demonstration at shows to educate producers in regard to the class of egg that should be sent to market and the one most desirable for the export trade An extension of such displays made at our agricultural and pastoral shows would prove a valuable object-lesson, particularly to those who require the lesson most—*i.e.*, the farming community Sometimes classes are provided for eggs at agricultural and pastoral shows, but too often the dozen largest eggs secures the chief honours quite irrespective of their being uniform in shape and of a good internal quality. Under such conditions, in the country-show class for a dozen eggs, one only requires to save up the double-yolked eggs, however stale they may be, to secure the award. Egg classes at shows will never serve the best purpose until the eggs are judged in accordance with standard requirements, and the competitors, as well as the judges, are familiar with the requirements of this standard, whereby the eggs must not only conform

to a desired size, but to a high degree of cleanliness, colour, bloom of shell, and whereby uniformity of shape must be considered, together with the colour of the yolk and the size of the air-cell, this being an indication of age.

Hereunder is the recognized New Zealand standard of excellence by which egg classes in shows can be judged :-

	Points
Size of air-cell, almost nominal	40
Weight of eggs (2 oz. standard)	20
Texture of shell (smooth and thick throughout)	15
Colour of yolk (deep orange)	5
Consistency of albumen (not watery)	5
Uniformity	5
Shape	5
Clean shells (natural bloom desired)	5
Total points	100

Serious Defects.—Blood spots and stains, cloudy yolks, developed germs, adhesion of yolks to shell, malformations

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Winter Precautions.

BEFORE the cold weather sets in every hive should be examined in order to make sure that the frames are completely covered with sufficient dry well-fitting mats to keep the bees protected Wherever a damp or mouldy mat is discovered it should be replaced with a dry one, and the roof examined and repaired. No draughts should be allowed around the frames. Mats made of corn-sacks cut to the exact size of a zinc queen-excluder answer all requirements of warmth. Steps should be taken to ensure that they are placed in their exact position. If placed crookedly the edges are apt to be pushed out between the hive-body and the roof, and will in time absorb enough moisture to make them damp and unwholesome.

Once more the time approaches when the necessity for shelter should impress itself on the beekeeper. It is most essential that the bees be protected from cold winds during the winter. Should no permanent shelter be available, something temporary should be erected if the bees are expected to prove in normal condition in the spring. Manuka scrub is excellent for making a temporary wind-break.

Weeds and grass should be kept down. A good clearing round the hives in autumn will suffice until spring, and will add materially to the comfort of the bees and the well-being of the hives. Not only should the entrances be cleared, but the ground all round the hives similarly treated, and the weeds raked up and destroyed.

Care of Hives.

At no other season is the welfare of the hives of such importance as during the next few months. Every hive should be raised from the ground to the height of one brick, and if the situation is damp or low-lying it is a good plan to raise the hives still more. This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring that the hives have a free current of air beneath the bottom-boards and are thus more likely to keep dry. The bottom-boards should never be resting on the ground, or they will rot in very short time and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because the beekeeper will usually find that towards the end of the honey-flow the bees will use much valuable time in gathering propolis to paste up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

Apart from disease, there is no worse feature in an apiary than the presence of leaky hive-covers. A roof which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost sets in. There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should cover them either with zinc, ruberoid, or some other water-proof material If economy must be practised he may cover with cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective water-proofing, and one which anybody can apply.

Plans for Next Season.

During the off-season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are crying out for room, and it should be finished long before the actual time for increasing one's stock arrives. The bee-keeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and, while the bees are in a dormant condition, study the best methods of improving his stocks. Neither weather conditions, locality, nor any other factor will influence the honey crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these be in existence during the following summer.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Some Notes on Pruning.

TREES, shrubs, and climbers frequently fail in the many objects for which they are grown through the neglect of pruning. The results vary according to the kind or variety of the subject, but to obtain straight timber, a close even shelter-hedge, regular heavy fruit crops easily gathered, &c., growth must generally be more or less directed and controlled by pruning.

It is most important that attention should be given for the first few years after planting, as neglect at that period often leads to results that are most difficult if not impossible to correct satisfactorily later. Coniferous plants are to some extent an exception, as they usually follow a naturally simple and satisfactory plan of growth with a single central leader. Sometimes one finds a conifer with a strong branch competing in growth with the leader and spoiling the balance of the tree: its complete removal at an early stage is generally advisable. Plants of the coniferous class, used for shelter belts and hedges, are naturally well furnished with branches about the base, when exposed to the light, and require no

"topping" until the desired height is attained By planting them rather closely together in the line, according to the richness of the soil, the height can often be restricted so that little or no topping is necessary at any time.

In the same way such popular deciduous shelter-trees as poplar and silver birch may often have their growth regulated to suit the circumstances. When these trees are planted with evergreen hedge plants, strong competitive branches which they may have should be removed completely and the leading growth topped to a bud on the weather side to invigorate the plant and hasten development: this will keep them well ahead of the evergreen growth below.

Escallonias and other shrubby hedge-plants, on the other hand, when allowed to grow up without much topping, as is frequently done with a view to quick development, are thin and bare about the base just where the shelter is most required. To make them stool out and form a rather broad and well furnished base they should be cut hard back after planting, and annually for a few years afterwards. This may slightly delay the full development, but will provide efficient shelter of good appearance.

Bush fruits, such as gooseberries and red currants, must be carefully trained along approved lines and receive annual pruning attention at this season if they are to be kept in profitable condition. They are of a vigorous constitution and quickly become overgrown and woody if neglected. They should be trained with one stem from the ground into a well-spaced bush with an open centre. In the case of matured bushes the laterals on the red currant should be spurred back, and the gooseberries should have the laterals which have borne fruit cut down to the base bud. Weak laterals of last season's growth may be treated in the same way, as they are unlikely to be fruitful. Superfluous wood, especially suckers, should be removed completely. This leaves the best of the young wood for cropping during the coming season. The black currant is of quite a different habit. a moist soil and somewhat shaded conditions provide a congenial environment, so that an open centre in the bush is unnecessary. All that is required is to obtain vigorous annual growth, as it is that which produces the best fruit. Young plants should be headed "hard back" to encourage growth, and in older plants the wood that has borne should be cut similarly to a point just above a bud. As suckers are fruitful they should not be suppressed.

With other sundry fruits and nuts the same principles apply: by cutting a young plant to carefully selected wood buds a tree or bush of approved design is built up quickly, having strong well-placed branches without crowding. Such early training is all-important, as when it is well done the plant may always be brought back into a profitable state even after a period of neglect.

The removal of large limbs from mature trees should be done with special care: they should be cut just beyond a lateral growth or close up to the branch or trunk from which they have sprung. An upward cut with the saw must be made in the limb some inches beyond the final cut, which is made afterwards by sawing downwards at a carefully selected angle. In some instances the work should be duplicated by severing the limb as described some distance from the final cut, and, when it is clear, removing the stump by the same method. Paint or tar should be applied to the wound, which will then heal quickly without risk of decay.

Maintaining Fertility in the Soil.

With land in good heart and the necessary shelter provided, sowing and planting may be done with confidence that the crop will generally be good and vary only with the weather conditions experienced. The

main point is to keep the soil in a fertile state: a good judgment of soil conditions, and how they may be best amended, is the greater part of the knowledge required for successful cropping.

A good new loam carefully broken in to destroy all weeds will usually carry good crops for a few years with little trouble and small expenditure on chemical fertilizers. But new land that may be rich but has been water-logged to some extent and had to be drained will take time to become aerated and release the plant-foods it contains. In doing this an application of lime may be of assistance, finely ground limestone or air-slaked burnt lime being harrowed in after winter ploughing or digging, so that it will have ample time to counteract acidity, and by making the stiff soil more friable so making plant-food available as well as improving drainage.

Where new land is composed very largely of sand or clay, the possibilities are there if, water and drainage being provided, the fertility of the soil is built up by providing humus. This, too, will take time, as not until the organic matter incorporated in the soil is assimilated is it available to the plant, and as the capacity for assimilation is more or less limited it sometimes takes years to build up a black, light, rich soil from such beginnings. Materials that may be used for this purpose are seaweed, farm and stable manure, or almost any kind of vegetation that will decay quickly. This vegetation may be grown as a cover crop, such as oats, barley, mustard, peas, beans, or vetches, and turned under where grown, or it may be cut and carted on to the land for turning under. Seaweed is not by any means the least useful for the purpose: for sandy lands in the vicinity of the coast nothing better could be used. Where large quantities are available the cost of carting is the only limit to its use.

However good the land may be originally, or however well it may have been built up into a fertile state, cultivation and cropping use up the supply of humus, and crops become very small and the soil harsh, often with a tendency to set hard unless the supply is maintained. This happens most quickly in a light soil, which is for that reason called hungry, as compared with a retentive heavy soil, where leaching and oxidation are much slower. To maintain fertility, supplies of humus are dug in during the winter, annually, with few exceptions.

The addition of such elements as nitrogen, phosphorus, and potash, in concentrated form, in which they are known as chemical or artificial fertilizers, is also made then or later, as may be most suited to the crop in view. Where humus is supplied in sufficient quantities phosphates are usually the most important fertilizers in demand by crops: they may be supplied now by turning in such slow-acting forms as basic slag or finely ground bonedust and supplementing it shortly before planting or sowing with moderate dressings of superphosphate, which is to a great extent water-soluble and immediately available. Potash is often required in light soils, and may be applied now in the form of kainit, which has the additional advantage of destroying slugs, which are so troublesome during the spring amongst young seedlings. Finely ground copper sulphate, 18 lb. per acre, mixed with the kainit will improve the dressing as a slugicide; copper sulphate in any form is most effective in destroying this pest. Potash is also useful to balance up the effect of heavy dressings of nitrates, which may easily be injurious otherwise. During the growing-season it is best applied as sulphate of potash. Wood ashes stored in a dry place are also rich in potash. Humus generally contains sufficient quantities of nitrogen for the present. Nitrogen, however, can often be applied to crops which require forcing in early spring before the temperatures are sufficiently high for nitrifying bacteria to become active. Nitrate of soda is usually the best form for light soils, and sulphate of ammonia for heavy soils, and as they are liable to be lost by leaching these expensive

fertilizers are applied in small quantities from time to time as required. Soot which has been stored for a few months under dry conditions is also a valuable nitrogenous fertilizer with useful effects as an insecticide: it may be used freely for these purposes at almost any season.

The Tomato Crop under Glass.

When the seedlings have the first pair of true leaves developing, they should be pricked off into boxes filled with soil composed of a good fresh loam with sufficient well-rotted manure to supply humus and sand to keep it open The plants should be set about 2½ in. apart each way. It is advisable to place them in the ground about up to the seed-leaves, firm the soil about the roots, but avoid carefully the least injury to the stem. The boxes should then be returned to the propagating-house or hotbed, and on the following day when the plants have straightened watered with tepid water through a fine rose. They should be watered again only when it is plainly necessary, and then with tepid water. It is advisable to ventilate freely whenever temperatures permit. Grown in this way with an average temperature of 55° F. a steady, sturdy growth will be obtained, and the plants set out later will grow without receiving a check which so seriously interferes with cropping.

Towards the end of June, where final planting out is done in July, the soil in the house should be thoroughly watered in preparation for planting. In many houses where the soil has been allowed to get dry probably two applications will be necessary not only the top soil but the subsoil should be thoroughly wet, so that at planting-time the ground will be sufficiently warm and moist for the plants to grow unchecked with little more watering before the warm weather arrives

The Homestead Garden.

The above remarks on pruning have an important application in this section Trees and shrubs sometimes show a tendency to straggling or erratic growth, which should be checked by pruning at this season so that the vigour of the plant may be evenly distributed. There is a good deal of art as well as science in carrying out these operations, which should be done only after fully considering the circumstances of each subject. A branch may generally be completely eliminated by severing it close up to its point of origin, or invigorated by cutting new growth back to wood buds, or brought into flower and fruit and growth steadied by summer pruning The reactions will vary with plants of different kinds, but a very great number of plants are amenable to such treatment. Many kinds of shrubs flower on the young wood, and a crop of wood of good quality must be obtained annually to provide a display: this is done by cutting the wood back to a base bud after it has flowered. A rule with hardly any exception is to avoid a crowded condition of limbs or laterals in any part of the tree or shrub light is the first requirement of any green plant in all its parts above ground.

Young hardwood plants require careful pruning after setting them out. In some cases they require cutting back to make them stool out; in others the bushy growth is too crowded and has to be cut away, leaving three or four well-selected branches which are shortened to buds that will make well-balanced growth. Most kinds of conifers, heaths, and rhododendrons are exceptions, and require little pruning at this stage.

—*W. C. Hyde, Horticulturist, Wellington.*

On page 237 of the April *Journal* the amounts of brown-top seed exported to the United States and to Australia are given as 560 tons and 160 tons respectively, whereas the amounts actually exported were 56 tons and 16 tons respectively; the amount of red clover exported to the United Kingdom given as 750 tons was 75 tons, and that exported to Australia, given as 830 tons, was 83 tons.

WEATHER RECORDS: APRIL, 1934.

Dominion Meteorological Office.

NOTES FOR APRIL

APRIL was a mild month with comparatively little stormy weather. Precipitation was again considerably below normal over the greater part of the Dominion, but after the first nine days rather humid and cloudy conditions prevailed and some good general rains were recorded. Towards the end of the month the ground was gradually becoming saturated, and the effects of the long period of dry weather seemed to be disappearing. Though the weather was not warm or sunny enough to cause vigorous growth of vegetation, a certain amount took place in all districts, and the situation as regards feed for stock is generally quite good.

Rainfall.—Heavy rains occurred in the high parts of Taranaki and the western and central portions of the South Island. Elsewhere totals were once more considerably below normal. The east coast of the North Island had a particularly dry month.

Temperatures.—As already indicated, for most of the country the month was a mild one, with temperatures above normal. In parts of the eastern districts of the South Island the excess amounted to over two degrees. In Hawke's Bay, however, where there was a prevalence of southerly winds, the position was exactly reversed. The Wellington Province also recorded mean temperatures which were on the cold side. The absence of very strong cold winds prevented serious ill effects from such low temperatures as were experienced. There were some cold nights just before the middle of the month, and on the 13th widespread frosts occurred. On the 27th there was a sharp fall of temperature, marking the first touch of winter. So far there has been little snowfall, but from the 25th the ranges had a fair coating.

Sunshine.—Less than the average amount of bright sunshine was recorded in most districts, but Nelson 197·3 hours, New Plymouth 191·0 hours, and Blenheim 187·6 hours, fared well, and the southern part of the South Island had slightly more than the average.

Pressure Systems.—At the beginning of the month pressure was above normal over a very large area extending from South Australia to beyond the Chatham Islands and from 25° to 55° south latitude. On the 1st the highest pressure was over Foveaux Strait and reached about 30·6 in. The centre of the anticyclone moved very slowly northwards and eastwards without reduction of pressure. Though barometers fell considerably on the 9th, there was a tendency for high pressure throughout the month.

Between the 8th and the 11th widespread rains occurred during the passage of a rather vigorous westerly depression. Some very heavy falls were recorded on the west coast and the main ranges in the South Island.

The next storm was a rather complex one, and affected some part of the country on each day from the 14th to the 18th. On the 16th and 17th rain was almost general, the west coast again recording heavy falls. Northerly gales blew in many places on the 17th.

The most general rains were associated with a third storm system which slowly crossed the Dominion between the 21st and 25th. This also was responsible for very heavy falls in western districts and the ranges of the South Island. There were northerly gales on the 23rd. Snow fell on the ranges on the 24th and 25th, and many hailstorms were reported. The depression was followed by a decided fall of temperature.

RAINFALL FOR APRIL, 1934, AT REPRESENTATIVE STATIONS

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.	Total for Year to Date.	Average for Year to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	2·85	12	0·88	4·42	10·59	14·96
Russell	4·09	15	1·26	4·25	12·68	13·77
Whangarei	2·27	17	0·64	4 93	12 04	17·18
Auckland	3·33	18	0·97	3·54	14·73	12·40
Hamilton	2·13	10	0·44	3·85	9·56	14·09
Rotorua	2·60	12	0·80	4·47	13·84	15·91
Kawhia	4·57	11	1·36	4·65	16·76	14·48
New Plymouth ..	5·32	13	1·29	4·60	15 68	16·30
Riversdale, Inglewood ..	9·89	13	3·07	8·11	23·71	28·69
Whangamomona ..	12·15	9	2·34	6·52	19·88	20·97
Hawera	2·69	6	1·30	3·48	12·49	12·40
Tairua	5·37	15	1·71	5·96	15·80	19·51
Tauranga	4·34	16	0·95	4·77	17 33	16·34
Maraehako Station, Opotiki	3·55	11	1·15	4·74	12·92	16·43
Gisborne	1·01	6	0·60	4·05	8·78	14·65
Taupo	2·21	9	0·58	3·60	13·50	12 85
Napier	1·28	7	0·53	2·78	12·14	11·62
Hastings	0·95	7	0·52	3·33	9·89	10·27
Whakarara Station ..	1·65	9	0·55	..	17·96	..
Taihape	1·76	7	1·05	2·79	10·82	10·79
Masterton	..	.	..	3·05	..	11·19
Patea	1·80	6	0·96	3·67	12·99	13·01
Wanganui	2·54	5	1·08	3·27	14·22	10·99
Foxton	2·25	7	0·94	2·50	10·61	8·69
Wellington	3·50	9	1·10	3·53	11·48	12·12
South Island.						
Westport	9·08	15	1·80	8·25	34·53	29·30
Greymouth	10·31	17	1·84	8·48	29·79	32·66
Hokitika	14·57	15	3·11	9·33	32·53	36·23
Ross	17·58	14	5·21	12·18	42·74	44·21
Arthur's Pass.. ..	22·06	12	5·78	15·42	51·13	52·63
Okuru, South Westland	..	..	..	14·12	..	50·52
Collingwood	8·99	13	2 28	8·15	20·93	25·81
Nelson	2·91	11	0·70	3·11	9·17	11·46
Spring Creek, Blenheim	1·73	8	0·75	2·12	5 20	8·50
Hanmer Springs ..	1·77	9	0·67	3·32	20·64	13·62
Highfield, Waiau ..	1·72	10	0·58	2·60	14·69	11·02
Gore Bay	1·01	8	0·34	2·38	15·99	9·77
Christchurch	1·13	8	0·76	1·86	7 88	7·76
Timaru	1·36	11	0·32	1·59	12·15	7·90
Lambrook Station, Fairlie	..	..	..	1·97	..	8·55
Benmore Station, Clear-burn	2·83	13	0·87	2·40	8·85	9·20
Oamaru	1·21	12	0·32	1·79	8·38	7·40
Queenstown	3·71	13	1·08	2·98	10·22	10·45
Clyde	3·59	11	1·35	1·45	9·20	5·85
Dunedin	2·17	16	0·36	2·77	12·49	11·87
Wendon	..	..	..	2·71	..	10·91
Gore..	3·71	..	..	3·12	..	12·10
Invercargill	3·43	19	0·60	4·14	13·79	15·14
Puysegur Point ..	6·05	18	0·99	7·67	22·91	29·00
Half-moon Bay ..	3·53	19	0·52	5·10	14·06	19·37

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FERTILIZING INFLUENCE OF LEGUMES.

A. D. M., Waipawa :—

Does a leguminous crop growing in association with a non-leguminous one impart any of its nitrogen to the latter crop whilst both crops are growing ? If not, when does the nitrogen become available ? Would it be beneficial or necessary to sow a nitrogenous manure with a crop of oats and peas sown together for ensilage ?

The Fields Division :—

There is only scant definite information on the point, but what there is suggests that a leguminous crop supplies nitrogen to a companion non-leguminous annual crop. There is much conclusive evidence that a leguminous crop benefits in respect to nitrogen an annual crop which occupies the same ground the next season. In the case of pasture where the decay of clover roots may be taking place, nitrogen from the clover does assist the growth of grasses growing in association. Under ordinary conditions it is neither necessary nor beneficial to apply a nitrogenous fertilizer with a mixed crop of oats and peas.

FEEDING OF LUPINS TO SHEEP.

A. D. M., Waipawa :—

What is the procedure to follow when grazing sheep on lupin The sheep will be ewes in lamb. I am led to understand that lupin is poisonous under certain circumstances. Could it be grazed for short periods daily ? Could it be used as a sole diet for a short period ? At what stage of growth is grazing commenced ?

The Fields Division :—

Experience of grazing lupins in this Dominion is very limited and confined principally to Canterbury So far as present experience goes, annual blue lupin cannot be claimed to be as palatable to sheep as most other crops, but when sown with either grass or rape kale the sheep learn to acquire a taste for it It may be fed in a green stage, but it appears to be preferable to feed it when the earliest pods are yellow to brown, when both the foliage and pods are more readily eaten Ewes in lamb must not be chased about when feeding on lupin, nor should very hungry sheep be turned on it, as there is a tendency to develop staggers, but no serious mortality has been reported and no trouble has been associated with careful handling. There appears to be no necessity to feed for short periods daily, but a run off into a grass paddock is preferred On the other hand, lupins can be fed for lengthy periods of a month to six weeks at least, provided sheep get used to it gradually

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CONTROL OF "WILD SHAMROCK."

T. W., Westport :—

I have in the garden a small bulb called "wild shamrock" or "four o'clock," and have tried to exterminate it by sieving the soil, but this method does not meet with any success as the bulbs are more plentiful than ever This bulb flowers in January and February, and when dug up at this time of the year has about twenty or thirty smaller bulbs attached Would you inform me if there is any method of extermination ?

The Horticulture Division :—

If the "wild shamrock" is growing in the flower-garden the land may be planted in shrubs which will overgrow the weed, or it may be laid down in grass, in which case the weed will be smothered out. If it is growing in the vegetable-garden trenching the weed in deeply is the best way of getting rid of it.

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WHEAT-MANURING EXPERIMENTS IN THE SOUTH ISLAND.

SUMMARY OF ELEVEN SEASONS' RESEARCH

Fields Division.

WHEAT-MANURING experiments have been conducted by the Fields Division of the Department of Agriculture over the past eleven seasons, and during that time one hundred and eighty trials have been harvested The detailed results of these have been published at various times in the *Journal of Agriculture* (see references at the end of this article). In the *Journal* for April, 1929(7),* the results up to and including the 1928-29 season were summarized and tentative recommendations made

Whereas the experiments covered by that summary were confined to Canterbury and North Otago, subsequently a few of the trials were extended to Marlborough(11, 12), Central Otago(11) and Southland(13), so that a wide range of soil types has been covered and a variety of seasons experienced during the eleven years' research completed to date. There is therefore a large amount of evidence on which to base recommendations to farmers regarding the manuring of wheat, and it is considered that this is an opportune time to review the work that has been done and to analyse the results secured

Problems under Investigation.

The earliest experiments (1923-24 to 1928–29) investigated, amongst other things, the relative merits of superphosphate, basic super, ephos, and Nauru phosphates, with the results indicated below under the heading of "Superphosphate compared with other Phosphates."

During the seasons 1929-30 to 1931-32 the effect of increasing the quantity of superphosphate from 1 cwt. to 2 cwt. per acre was investigated.

Preliminary work on the use of dried blood gave indications that more available forms of nitrogen might be of considerable benefit Consequently, more concentrated and quicker-acting nitrogenous fertilizers, such as nitrate of soda and sulphate of ammonia, were later put under trial, and for several seasons these were included in the general programme of experiments, which investigated not only the relative merits of each, but also different quantities and times of application.

* Figures in brackets indicate references at the end of this article.

Concurrently with this general investigation into the use of superphosphate and nitrogen, potash as an adjunct to super and to super plus nitrogen was also put under trial.

Also, following the conclusions from a grassland response-to-manure survey of Canterbury, which indicated a general response to liming, and because of a practice being adopted by a few farmers, carbonate of lime as an addition to super was included in the programme.

Technique.—In the *Journal* for July, 1926(15), a brief description of the methods employed in carrying out wheat-manuring trials was given. Slight modifications have been introduced from time to time, and these have been mentioned in the various reports presented in the *Journal*. The more up-to-date equipment now in use is illustrated in the *Journal* for April, 1929(7). From ten to twelve replications of each treatment were sown in most of the experiments, while in trials necessitating a greater degree of precision as many as twenty-four replications were used.

All results were examined statistically, "Student's" method being used generally.

Summary of Results.

SUPERPHOSPHATE.

Superphosphate compared with other Phosphates.

In twenty-nine trials in which superphosphate was compared with basic super,* each at 1 cwt. per acre, no case was recorded in which basic super was superior to super. The average results of these trials showed—

	Bushels per Acre.
Increase of super over no manure	5·5
Increase of basic super over no manure	4·3
Difference in favour of super	1·2

The superiority of super over basic super is significant.

Seventeen trials compared superphosphate with ephos and Nauru phosphates with the following average results:

	Bushels per Acre
Increase of super over no manure	5·6
Increase of ephos over no manure	2·0
Increase of Nauru over no manure	1·5

The marked superiority of super is obvious and was consistent throughout all trials in which a significant phosphate response occurred.

Increased Yields as a Result of using Superphosphate at 1 Cwt. per Acre.

During the eleven seasons under review 124 experiments have been carried out in which 1 cwt. super per acre has been compared with no manure. The average increase due to the use of super in these trials was 4·1 bushels per acre.

* So-called "commercial basic super" has varied in its composition. At the time these trials were conducted the material used was probably a mixture of 60 parts superphosphate, 20 parts Nauru phosphate, and 20 parts carbonate of lime. It is probable that the present-day basic super is merely a mixture of about 90 parts of superphosphate with 10 parts of lime (burnt or carbonate).

Only sixteen experiments have failed to give statistically significant increases, while the remaining 108 have shown significant increases of from 1 bushel to 13·8 bushels per acre. In every experiment the difference, however small, has been in favour of superphosphate.

The number of these experiments in each season, together with the average increase due to super in each, is as follows :—

Table 1.—Showing Average Response to Super 1 Cwt. in each of Eleven Seasons.

Season.	Number of Experiments.	Average Increase due to Super 1 Cwt (Bushels per Acre)	Range of Increases. (Bushels per Acre.)
1923–24	2	4·7	0·4 to 9·0
1924–25	7	6·0	0·2 to 10·8
1925–26	4	2·5	1·0 to 4·4
1926–27	5	2·9	1·0 to 5·0
1927–28	6	3·9	0·4 to 8·1
1928–29	12	6·1	1·2 to 13·8
1929–30	32	3·8	0·4 to 7·0
1930–31	26	3·2	0·4 to 7·6
1931–32	19	5·2	2·1 to 12·8
1932–33	3	3·4	2·2 to 7·6
1933–34	8	2·4	0·4 to 6·8
Average of all trials	124	4·1	0·2 to 13·8

Returns from Use of 1 Cwt. Superphosphate.

During the eleven seasons under review the prices of wheat and superphosphate have fluctuated to a certain extent, but more or less proportionately, so that in practically each season it could be said, broadly speaking, that an extra return of 1 bushel of wheat would pay for an application of 1 cwt. of super.

As only twelve experiments out of 124 have given increases less than 1 bushel from the use of 1 cwt. of super it is obvious that the latter is a profitable and safe investment.

Effect of Prior Crop on Phosphate Response in Wheat Crop.

That the effect of superphosphate on the wheat crop is not influenced by the prior crop to an extent which need be considered in practice is shown by the following analysis :—

Table 2.—Showing Relationship between Response to Superphosphate and Prior Crop in 116 Trials.

Crop preceding Wheat Experiment.	Number of Experiments.	Average Increase due to Super 1 Cwt. (Bushels per Acre.)	Range of Increases. (Bushels per Acre.)
Grass	32	5·1	0·9 to 13·8
Wheat, oats, or barley ..	36	3·4	0·4 to 9·0
Potatoes	14	4·8	0·5 to 10·8
Peas, vetches, or lupins ..	12	3·2	0·4 to 8·1
Rape or turnips ..	22	4·6	1·7 to 10·3

From the above it will be observed that there is a tendency for the effect of super to be most pronounced when the prior crop is grass.

Effect of increasing the Quantity of Super from 1 Cwt. to 2 Cwt.

A total of thirty-eight experiments has been carried out in which super 2 cwt. has been compared with 1 cwt. The average superiority of the larger quantity over the smaller has been 0·2 bushels per acre. Since only five of these experiments have shown significant increases in favour of super 2 cwt. and four others have actually given significant decreases when the larger quantity has been used, the use of more than 1 cwt. of super for wheat cannot be recommended in general. The districts in which the 2 cwt. was superior to 1 cwt. were—(*a*) Tua Marina and Renwicktown, Marlborough(11 and 12); (*b*) Rangiora(13); (*c*) Springbank, North Canterbury(11).

POTASH.

Summary of Effect from 1 Cwt. of Muriate of Potash added to Super 1 Cwt.

Since the 1927–28 season there have been forty trials in which 1 cwt. of muriate of potash added to super was compared with super alone. Of these, seven experiments showed significant increases from the use of potash, but the increase was sufficient to meet the cost of the fertilizer in one experiment only. In nine experiments significant depressions in yield resulted.

The average yield of super plus potash in the forty trials is 0·5 bushels *lower* than the average of the plots treated with super only.

In the above trials plots sown with super plus potash and afterwards top-dressed with nitrate of soda yielded on an average 0·8 bushels *less* than those receiving super plus nitrate of soda.

In these experiments the muriate of potash was mixed with the super and applied with the seed, resulting in a number of cases in delayed, and in a few cases in reduced, germination.

NITROGEN.

In recent years much work has been done on the effect of different nitrogenous fertilizers on the wheat crop. Following the success which attended the top-dressing of wheat crops with nitrate of soda in the 1925–26, 1926–27, and 1927–28 seasons, numerous experiments were carried out to compare the effect of sulphate of ammonia with that of nitrate of soda, and the effect of increasing the quantities of both. Several experiments were also conducted to determine the best months of application not only of nitrate of soda and sulphate of ammonia, but also of other nitrogenous fertilizers—viz., urea, calcium cyanamide, and calnitro. The results of a few experiments with nitro-phosphatic fertilizers are also discussed below.

General Effect of Nitrate of Soda over Period of Eight Seasons.

Altogether 129 experiments have been completed in which nitrate of soda at 1 cwt. per acre top-dressed on plots sown with super can be compared with plots not top-dressed.

The results during each of eight seasons are shown in the following table :—

Table 3.—Showing Average Response to Nitrate of Soda 1 Cwt. in each of Eight Seasons.

Season.		Number of Experiments	Average Increase due to the Use of Nitrate of Soda 1 Cwt. top-dressed (Bushels per Acre.)	Range of Differences. (Bushels per Acre)
1925–26	..	1*	5·9	..
1926–27	..	3	3·1	+1·0 to 5·2
1927–28	..	7	5·3	−0·8 to +11·1
1928–29	..	14	4·6	−0·4 to +10·8
1929–30	..	33	4·4	−1·7 to +10·7
1930–31†	..	30‡	2·9	−0·9 to +6·4
1931–32†	..	21‡	0·8	−2·7 to +5·2
1932–33	..	20‡	2·2	−0·6 to +9·5
Average	..	129	3·2	..

* Nitrate of soda at 93 lb. † Unusually dry seasons. ‡ Includes thirteen experiments in the three seasons in which nitrate of soda at 149 lb. was used.

It will be seen from Table 3 that there is a considerable variation in the average response to nitrate of soda from season to season, and that the results in the last three seasons were considerably lower than in the three preceding ones. Moreover, the variation in the magnitude of effect has been considerable, being as high as 11·1 bushels in one experiment and as low as −2·7 bushels.

Twenty-three experiments show lower yields from super plus nitrate of soda than from super only, although in only two of these is the reduction statistically significant.

Effect of Prior Crop on Response of Wheat Crop to Nitrogen.

An analysis of the effect of nitrate of soda in relation to the prior crop is presented in Table 4 :—

Table 4.—Showing Relationship between Response to Nitrate of Soda 1 Cwt and Prior Crop

Crop preceding Wheat Experiment.		Number of Experiments	Average Increase due to Nitrate of Soda	Number of Experiments in which Response was Greater than the Average of 3·2 Bushels
Grass	..	32	2·8	14
Wheat, oats, or barley	..	39	4·3	28
Rape or turnips	..	31	2·1	8
Peas, vetches, or lupins	..	10	3·5	4
Potatoes ..	..	8	3·9	4
Other crops ..	..	9	3·6	5
Total	..	129	..	61
Average of all trials	..	..	3·2	..

Table 4 indicates that generally wheat following a cereal has responded to the top-dressing of nitrate of soda better than where wheat follows grass or rape and turnips, and that the effect as indicated by the last column has been more consistent. The number of trials on wheat following the other crops mentioned is rather small to warrant comment.

It is obvious that the average effect on 1 cwt. of nitrate of soda is not sufficient to warrant a recommendation for its general use. At the present time wheat is worth about 3s. 3d.* (*i.e.*, selling-price less cost per bushel of threshing, bags, cartage, railage, commission, &c.), and nitrate of soda costs about 13s. 6d. per hundredweight ex store. Consequently at least 4 bushels of wheat are required to meet the cost of 1 cwt. of nitrate of soda. Even if sulphate of ammonia, 1 cwt. of which would appear to be slightly more effective than 1 cwt. of nitrate of soda, is used, the average increase of 3·2 bushels per acre barely meets the cost of 1 cwt. of sulphate of ammonia, which is in the vicinity of 11s. per hundredweight ex store.

It must be borne in mind that in the trials recorded here nitrogen was used irrespective of the prior crop or whether the crop showed symptoms of nitrogen deficiency in the spring. The fact that the greatest average effect from nitrogen was on crops following cereals suggests that under such conditions, especially if crops show symptoms of nitrogen starvation, the use of 1 cwt. of a soluble nitrogenous fertilizer may be profitable. Future work with nitrogen must be along the lines of determining its effect on those crops which appear in need of it in the early spring.

Comparison between Nitrate of Soda and Sulphate of Ammonia.

Thirty-two experiments have been carried out comparing nitrate of soda at 1 cwt. with sulphate of ammonia 1 cwt. The average superiority in favour of the latter has been 0·5 bushels per acre.

Since sulphate of ammonia has been at a consistently lower price during the past few seasons than nitrate of soda, and from the fact that on the average it has outyielded the latter by 0·5 bushels per acre, sulphate of ammonia would appear to be the better proposition where nitrogen is being used.

There have been twenty-four experiments in which nitrate of soda at 1½ cwt. could be compared with the same quantity of sulphate of ammonia, and in these the average superiority of the latter is 0·9 bushels per acre.

Effect of increasing the Quantity of Nitrogen.

In twenty-four experiments in which nitrate of soda at 1 cwt. and 1½ cwt. respectively was applied, the average superiority of the larger quantity is 0·4 bushels per acre.

Sulphate of ammonia at 1 cwt. could be compared with 1½ cwt. in thirty-two experiments. In these the average superiority of the larger quantity was 1·1 bushels per acre.

In these experiments the nitrate of soda was top-dressed in late September, while the sulphate of ammonia was top-dressed about a

* This is based on the Wheat Pool price of 3s. 6d., plus a probable bonus of 9d. a bushel.

month earlier than this. Such times of application were regarded as being the most suitable from indications given in carefully planned trials on this aspect of nitrogenous top-dressing.

Increasing the quantity of nitrogen from 1 cwt. to 1½ cwt. has not been accompanied by increased yields commensurate with the additional cost.

Times of Application of Sulphate of Ammonia and Nitrate of Soda.

In thirteen trials conducted over four seasons(9, 10, 13, and 14) the effect of time of application of sulphate of ammonia and nitrate of soda as adjuncts to 1 cwt. of super per acre has been investigated. Application of sulphate of ammonia at 1 cwt. in August and late September, and dressings of nitrate of soda at 149 lb. in August, September, and October respectively have been made in all thirteen experiments, with the following results:—

*Table 5 – Showing Average Increase due to Sulphate of Ammonia 1 Cwt per Acre and Nitrate of Soda 149 lb * per Acre over no Nitrogen.*

Treatment	Time of Application	Average Increase over No Nitrogen. (Bushels per Acre)
Sulphate of ammonia 1 cwt	August ..	3·0
	September	3·0
Nitrate of soda, 149 lb	August ..	3·5
	September	4·4
	October ..	4·0

* Containing quantity of nitrogen equivalent to that in 1 cwt sulphate of ammonia

In four trials late October applications of sulphate of ammonia have been made, but the average increase over no nitrogen in the case of this treatment was only 3·1 bushels as compared with 4·3 bushels from September dressings of sulphate of ammonia in corresponding trials.

In the 1931–32 season three experiments(13) and in the 1932–33 season eighteen experiments(14) were conducted in which 1 cwt. of sulphate per acre mixed with superphosphate and sown with the seed in the winter was compared with spring applications of sulphate of ammonia to plots sown with super in the winter. The results were as follows:—

		Average Increase over No Nitrogen: Sulphate of Ammonia with Seed	Sulphate of Ammonia top-dressed in Spring
1931–32:	Three experiments ..	3·4	2·3
1932–33:	Eighteen experiments ..	0·9	2·5

The very poor results from the application with the seed in 1932–33 are probably due in part to its harmful effect on germination which was apparent in a number of trials.

From the evidence put forward it is apparent that the best time to apply sulphate of ammonia is either in August or September, while nitrate of soda is best applied from about the middle of September to the middle of October. The risk of serious germination injury is against the use of sulphate of ammonia at seeding, at least, when it is drilled in with superphosphate in contact with the seed.

OTHER NITROGENOUS FERTILIZERS.

Three other nitrogenous fertilizers—urea, calcium cyanamide, and calnitro—have been tried out against nitrate of soda or sulphate of ammonia in two experiments. These were included in the earlier trials(9 and 10) investigating time of application of nitrogen. Equivalent quantities of nitrogen and/or phosphate were applied in each case. The results, however, indicate that these forms of nitrogen are slightly inferior to nitrate of soda top-dressed in September on wheat which has been sown with super, although in the 1930–31 season all were superior to sulphate of ammonia when applied in August, but not significantly so. Results in both seasons indicate that urea, calcium cyanamide, and calnitro give better results applied in August than when applied in September or October.

Effect of Super (with Seed) plus Sulphate of Ammonia (top-dressed) compared with Concentrated Fertilizers containing Equivalent Quantities of Phosphate and Nitrogen.

Two experiments were carried out in the 1925–26 and 1926–27 seasons(3 and 5) in which Ammo-Phos* (16·5 per cent. N. and 20 per cent. P_2O_5) at 100 lb. per acre was compared with equivalent quantities of phosphate and nitrogen in super plus sulphate of ammonia. Ammo-Phos was significantly lower in yield in 1925–26 by 0·8 bushels per acre. In 1926–27 it was superior, but not significantly so, by 0·4 bushel.

In the 1932–33 season MAP2,† containing 18 per cent. nitrogen and 18 per cent. phosphoric acid, at 127 lb. per acre at seeding, was compared with super 1 cwt. (at seeding) plus sulphate of ammonia 1 cwt. (top-dressed). The yield of the former was 57·5 bushels per acre, while the latter yielded 56·8 bushels. The difference between them was not significant.

Leunaphos‡ containing 20 per cent. nitrogen and 20 per cent. phosphoric anhydride was tried out in eight experiments in the 1930–31 season. It was used to supply extra phosphate to plots sown with 1 cwt. of super, and as a nitrogen addition. It was applied as a spring top-dressing in September or October about a month later than sulphate of ammonia applications. In most cases it was inferior in effect to the sulphate of ammonia in spite of the phosphate which it supplied. It is probable that the lateness of its application detracted from its effect.

EFFECT OF CARBONATE OF LIME AS AN ADDITION TO SUPER.

The use of carbonate of lime 2 cwt. per acre as an addition to super at 1 cwt. was investigated in thirty-seven experiments. Of these only nine showed increases of from 1½ bushels to 2½ bushels of wheat. Generally speaking, these increases occurred on soils highly deficient in lime, although other soils equally deficient have not given responses. The use of lime as an addition to super sown with wheat cannot therefore be recommended generally, although in some places its use has been shown to have some effect.

* An American fertilizer. † An English fertilizer. ‡ A German fertilizer.

SUMMARY.

1. The results of 180 experiments on the manuring of wheat conducted over the past eleven seasons have been discussed and analysed.

2. Nearly all trials were carried out on a co-operative basis on private farms, from ten to twenty-four replications of each treatment being sown.

3. The results of all experiments were submitted to statistical examination, "Student's" method being used generally.

4. The chief objects of the trials were :—

(a) To compare various phosphates with no manure :
(b) To determine the effect of increasing the quantity of super from 1 cwt. to 2 cwt. per acre ;
(c) To determine the effect of using potash as an adjunct to super and super plus nitrogen :
(d) To determine the effect of using nitrogen as an adjunct to super and super plus potash :
(e) To compare the effects of different forms of nitrogenous fertilizers, and different times and quantities of application :
(f) Comparison of lime plus super with super.

5. During the eleven seasons under review 124 experiments have been carried out in which 1 cwt. super has been compared with no manure. The average increase due to the use of super in these trials was 4·1 bushels

The use of 1 cwt. of superphosphate per acre at time of sowing the wheat crop, irrespective of the previous crop, is strongly recommended.

6. The average superiority of super at 2 cwt. per acre over 1 cwt. in thirty-eight experiments was 0·2 bushels per acre.

The use of a greater quantity than 1 cwt. super cannot in general be recommended with the wheat crop.

7. Phosphates such as basic super, ephos, and Nauru phosphate have proved inferior to superphosphate.

8. The average yield of super plus muriate of potash in the forty trials in which it was compared with super alone was 0·5 bushels per acre *lower* than the super plots. A complete manure containing muriate of potash was 0·8 bushels lower yielding on the average than phosphate plus nitrogen.

9. The average increase due to the top-dressing of 1 cwt. nitrate of soda in 129 experiments was 3·2 bushels per acre. At present prices such an increase would not cover the cost of the fertilizer.

10. Wheat following a cereal crop generally responded better to applications of nitrate of soda than where wheat followed grass, rape, or turnips.

11. In general, the effect of sulphate of ammonia was slightly superior to that of nitrate of soda when equal weights per acre of the fertilizers were used.

12. The effect of increasing the quantities of sulphate of ammonia and nitrate of soda respectively from 1 cwt. to 1½ cwt. was for the additional ½ cwt. to increase the yield over that from 1 cwt. by 1·1 bushels per acre in the case of the former and 0·4 bushels in the case of nitrate of soda.

13. From the results of thirteen trials conducted on times of application of nitrogen it appears that the best time to apply sulphate of ammonia is in August or September, while September and October are the most favourable months for nitrate of soda applications. The use of sulphate of ammonia with super at seeding is not recommended.

14. The effect of other nitrogenous fertilizers is discussed.

15. The results of thirty-seven experiments in which the effect of carbonate of lime added to super was under trial indicates that the use of lime cannot be recommended generally, although it has caused small increases in yield in some cases.

REFERENCES.

The results of all experiments on which this article is based will be found in the *Journals* indicated below :—

(1) Wheat-manurial Tests in Canterbury. Vol. 30, April, 1925, p. 229.
(2) Wheat-manurial Experiments in Canterbury. Vol. 32; August, 1926, p. 106.
(3) Ashburton Experimental Farm: Work of the 1925-26 Season. Vol. 33, November, 1926, p. 316.
(4) Wheat-manuring Experiments in Canterbury, 1926-27. Vol. 35, September, 1927, p. 182.
(5) —— 1926-27. Vol. 35; October, 1927, p. 251.
(6) —— 1927-28. Vol. 36, May, 1928, p. 339.
(7) —— Summary of Six Seasons' Research. Vol. 38, April, 1929, p. 221.
(8) —— 1928-29. Vol. 38, May, 1929, p. 337.
(9) Nitrogen Top-dressing of Wheat: Season 1929-30. Vol. 42, March, 1931, p. 185.
(10) —— Season 1930-31. Vol. 43, July, 1931, p. 46.
(11) Wheat-manuring Experiments in the South Island: Season 1929-30. Vol. 41, July, 1930, p. 29.
(12) —— Season 1930-31. Vol. 42, May, 1931, p. 311.
(13) —— Season 1931-32. Vol. 45; August, 1932, p. 80.
(14) —— Season 1932-33. Vol. 47, September, 1933, p. 166.
(15) Field Experimental Methods. Vol. 33, July, 1926, p. 6.

—*A. W. Hudson, Crop Experimentalist.*
J. W. Woodcock, Assistant Crop Experimentalist.

Contamination of Milk through Teat Canals.—It quite frequently happens that cows wade in pools of filthy water or lie down in soil contaminated with objectionable germs. In this way the outside of the udder and teats become heavily infected so as to necessitate very thorough washing. At the tip of the teat is a short canal about ½ in. long, in which, after milking, a little milk always remains. It is possible for objectionable germs from water or manure on the udder to develop in the portion of dried milk at the end of the teat, and so infect the milk in this short canal. All the milk drawn from the udder must pass through this heavily infected canal. This is the explanation for the trouble which has occurred from time to time on farms where machines and utensils are kept in a thoroughly clean and sanitary condition. After bad second-grade curds have been obtained the trouble has sometimes been traced to one or more cows which have such infection in their teats. To avoid trouble of this kind cows should be prevented from wading in stagnant water and kept out of badly fouled night paddocks. In the best dairies the practice is adopted of discarding the first two or three squirts from each teat so as to prevent the bulk milk from being heavily infected from the teat canal.—*Wallaceville Dairy Laboratory Note.*

HAIRY FIBRES OF THE ROMNEY SHEEP.

IV. FIBRE TYPE ARRAYS AND HAIRINESS.

F. W. DRY, Massey Agricultural College, Palmerston North.

INTRODUCTION.

THE purpose of this article is to put forward the main ideas that have emerged in the work on the coat of the Romney lamb when the fibre types are considered not separately, but as collections or arrays. Our knowledge of fibre type arrays bears both directly and indirectly on the problem of reducing hairiness. This work was undertaken, however, primarily on general principle. From work on smaller mammals it was known what sort of facts ought to be discovered about the kinds of fibres that make up the coat. It was believed that if such facts were found out they would prove, in some way or other, useful to wool-growing.

At the outset one probable application was much in mind, in that it was anticipated that we should learn to detect with greater certainty at an early age which animals will prove desirable, and which undesirable, from the point of view of hairiness. It was expected that we should become able, relatively early in the life of the lamb, to judge of the hairiness of the first fleece, and to foretell the hairiness of future fleeces. It has been shown in earlier articles* how these hopes are being realized for hairiness of both the kemp and the non-kemp groups.

Further progress in this direction in regard to the fibres grown later in the follicles from which halo-hairs are shed is to be reported briefly later in this article. It is not now the object to record these facts about succession in kemp follicles in more than a preliminary way. Essential facts will be recorded about conditions associated with differences between individual animals in the fibres that grow later in the roots from which halo-hairs have been shed. This is to be done by way of showing the practical bearing of details which do not lend themselves to observation in the sheep-yards.

This account, like the earlier articles in this series, has reference, save where otherwise stated, to the middle of the back at the level of the last rib.

In the preceding article it was explained that the several fibre type arrays are distinguished by lesser or greater effects of the pre-natal check acting upon the fibres beginning to grow at a certain early stage before birth. It is a general rule in the development of the coats of mammals that the earlier a fibre begins to grow the bigger it is. This principle of initial advantage is of course of wide application. The fibres starting earlier are coarser and grow faster. Those that start to grow progressively later tend to be finer and grow more slowly. On the back of most lambs this rule does not hold completely. As one proceeds from the early to the late end of the fibre type array—that is, from the halo-hairs, to sickle-fibres, to curly-tip fibres, and to fibres without definite curls in the tip—it is true that the fibres do on the whole become finer. At the same time, it frequently happens that some of the sickle-fibres

* *Journal*, January, March, and May, 1933.

(fine sickle-fibres) and often, too, some curly-tip fibres (checked curly-tip fibres) are finer than the fibres standing next to them, both earlier and later, in the fibre type array. By its effect upon these sickle-fibres and curly-tip fibres, less pronounced or more pronounced, is the pre-natal check judged, and it is in this way, as explained before, that the fibre type arrays are classified. It would appear that the follicles that have reached a certain stage of development, at the time when this checking force is powerful, suffer more severely not only than those roots which are better established, but than those roots which are then at an earlier stage. If this be so, there is a critical stage of development at which a follicle is especially susceptible to the restricting influence of the pre-natal check. Studies of the development of the coat before birth are being made in my laboratory in the hope that something may be learnt about this checking force which must be postulated in order to explain so many features in the fibre types, and in the different collections of fibre types called arrays.

THE FIBRE TYPE ARRAYS.

The several fibre type arrays are now to be described somewhat more fully than in the last article. More will be said than previously about variations within the same kind of array, and about collections of fibres standing on the border-line between two arrays. Thus it happens sometimes that the fibres important in classifying the array are only slightly fine. At other times it happens that the fine fibres in question are very few compared with the coarser fibres with similar tips. Most of the names adopted for the arrays were suggested by Mr. Rudall With one exception, they are taken from topographical features, and give some impression of the effect attributed to the pre-natal check that is observable when representative fibres are arranged in the order of starting to grow.

The Plateau Array.— In this array (Fig. 1) there are no sickle-fibres. When the fibres are arranged in logical order there is a transition from halo-hairs to curly-tip fibres without any sickle-fibres standing between. Generally, there are fibres classed as super-sickles, with a large sickle-shaped end and coarse medulla in the neck region that is grown before birth, but there are no fibres with such apical ends with the neck which follows fine and not chalky throughout. Sometimes it is stretching a point to recognize even super-sickles, the transition being rather from halo-hairs to curly-tip fibres with hairy tips. In this array hairiness is usually much in evidence in the tips of big curly-tip fibres.

The pre-natal check is clearly unable to cause the neck of any fibre with a sickle-shaped end to be fine enough for that fibre to be classed as a sickle instead of a super-sickle. One explanation is that the check is feeble, another that the follicles of big fibres besides the halo-hairs have it in them to produce such coarsely hairy fibres that even a powerful or fairly powerful check is not able to make thoroughly fine the neck region of any fibre approaching a sickle-fibre in form. All my lambs with this array on the back have had grossly hairy curly-tip fibres.

All these lambs, it also happens, have had many halo-hairs on the back, but they have all been produced in breeding experiments in which they had an excellent chance to be born with many halo-hairs. The Plateau array is more common on the britch, where the coat is so


FIG. I. PLATEAU ARRAY, REPRESENTATIVE SERIES OF FIBRES FROM BACK OF LAMB AT FOUR MONTHS

a to *e*: Halo-hairs, larger and smaller, shed

f to *i*: Shed fibres, difficult to classify, to illustrate the transition from finer halo-hairs, through super-sickle fibres to hairy-tipped curly-tip fibres

j to *m*. Persistent fibres, with crisis-thinning in place of shedding, to illustrate the transition from halo hairs to hairy-tipped curly-tip fibres.

n to *p* Persistent curly-tip fibres, without crisis-thinning longer and coarser members of the curly-tip series

q to *t* Curly-tip fibres, shorter and finer

u: Fine fibre without curly tip (histerotrich)

often very coarse and hairy, and while halo-hairs are often plentiful there, Miss Galpin has found arrays on the britch best regarded as Plateau in which the fibres at the beginning of the array are only big enough to be considered super-sickle-fibres instead of halo-hairs.

It is a noticeable feature in this array that, as we proceed along the series of curly-tip fibres, from those with longer tips and more curls, to those with shorter tips and fewer curls, we may encounter a sudden drop in hairiness. It then comes about that with tips above a certain size almost all the fibres are very coarsely hairy, while with tips below a certain size almost all are much finer and less hairy. Accompanying differences in coarseness are corresponding differences in rate of growth in length, and these differences may be very marked. The staple then has a long-drawn-out or very wasty tip.

Sometimes in very coarsely hairy specimens that do contain sickle-fibres there will be a smaller number of fibres that fall into a Plateau series. These fewer fibres constituting a Plateau series are said to be " in parallel " with a Saddle array, or even with a Ravine array.

The specimens showing the Plateau array have always had the biggest persistent birthcoat fibres, from persistent super-sickles—even a few persistent halo-hairs may be present—to fibres some way along the curly-tip series, very hairy indeed. When in the same specimen halo-hairs are very abundant we have lambs conspicuously objectionable for hairiness on both counts.

The Saddle Array.—In this array (Fig. 2) chalky sickle-fibres are present, but not fine sickle-fibres. There is a direct transition from chalky sickle-fibres to chalky curly-tip fibres. This is another comparatively simple array. The pre-natal check is regarded as able to bring about the marked thinning in the necks of sickle-fibres, but as not powerful enough, in a typical Saddle array, to cause any of these fibres to remain fine after birth.

In some arrays classed as Saddle just a few fine sickle-fibres, or fine sickle-fibres and checked curly-tip fibres, are to be found, and are called in parallel with the Saddle series. In specimens from the back of a small number of lambs in which the great majority of the sickle-fibres—whether with large ends or with small ends—and of the curly-tip fibres with the longest tips, become chalky after birth, and in which the majority of the sickle-fibres of both sorts, together with some few chalky curly-tip fibres, are shed, there are present also appreciable numbers of fine sickle-fibres, some with larger sickle-ends, some with smaller, and checked curly-tip fibres. It thus comes about that there is present every known sort of fibre belonging to the region of the array upon which the classification of the array hinges. This array is called All-in. Amongst all these types chalky fibres are in the majority, so that the array is akin to Saddle. There is also much shedding, and shedding, as will be more apparent later in this account, tends to accompany a weak pre-natal check.

Occasional arrays are found, not very easy to place, in that while there are present relatively fine fibres on account of which one is inclined to call the array Ravine or Valley, as the case may be, yet these finer fibres are coarser than those of a typical array of the kinds just named.

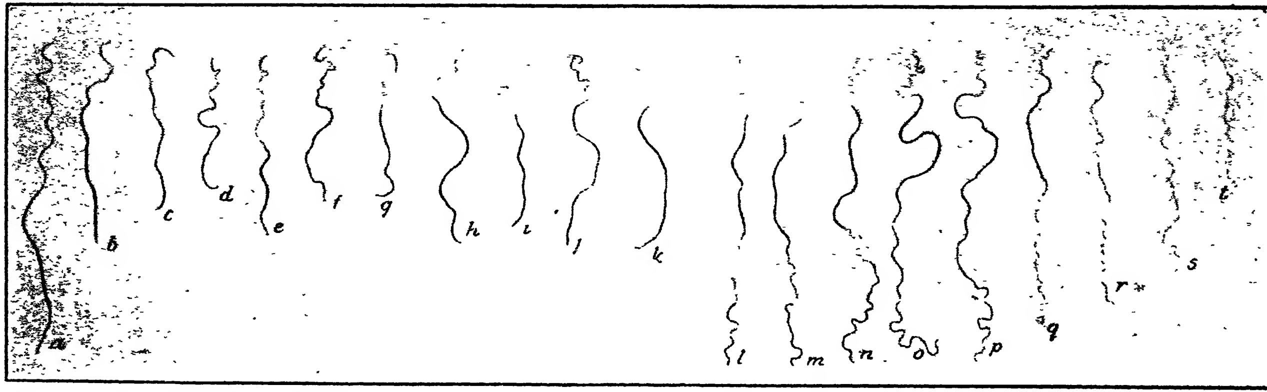

FIG. 2. SADDLE ARRAY, DIAGRAMS OF REPRESENTATIVE FIBRES, FROM BACK OF LAMB AT FOUR MONTHS. AS IN SIMILAR FIGURES, THE FIBRES ARE DRAWN AT NATURAL LENGTH, BUT DIFFERENCES IN DIAMETER ARE EXAGGERATED.

Shed :—

a : Halo-hair, large.
b : Small halo-hair or large super-sickle-fibre.
c to *f* : Super-sickle-fibres
g to *i* : Sickle-fibres, with sickle-ends large to small.
j : Hairy-tipped curly-tip fibre.
k : Curly-tip fibre, not hairy-tipped.

Persistent :—

l : Sickle-fibre with crisis-thinning.
m : Hairy-tipped curly-tip fibre with crisis-thinning.
n : Curly-tip fibre, not hairy-tipped, with crisis-thinning, tip with very many curls.
o to *r* : Curly-tip fibres, none with crisis-thinning, showing progressive reduction along the series in number of curls in the tip, in coarseness, and in length
s, *t* : Fine fibres without curly tips (histerotrichs).

The Saddle array has not been very common on the back in my material. Generally, the non-kemp portion of the Saddle array has been very hairy, or decidedly so. Sometimes hairiness extends well along the array—that is to say, to curly-tip fibres with tips by no means long, but sometimes the only curly-tip fibres that are hairy are those with the longest tips.

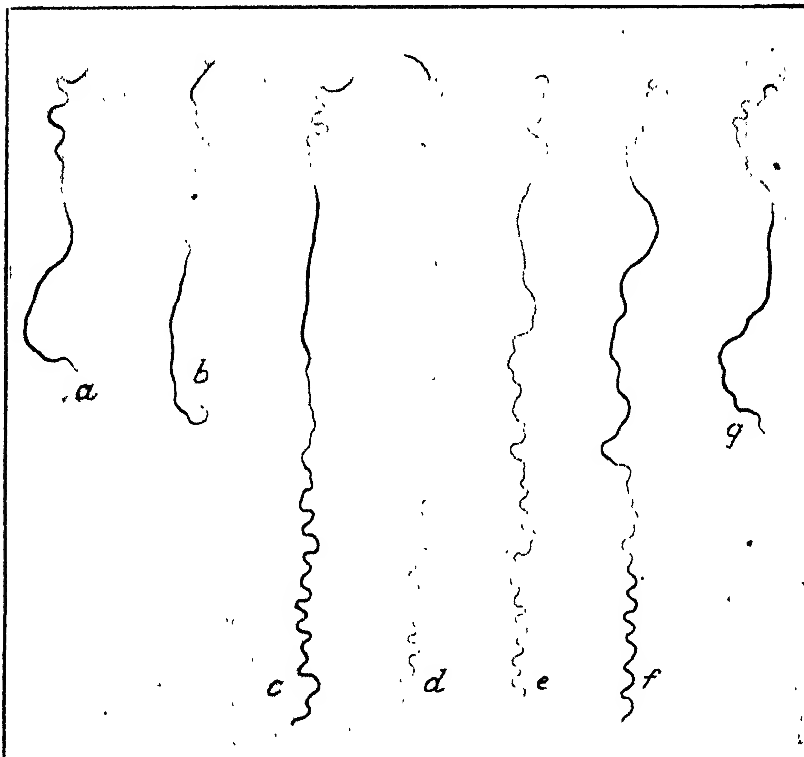

FIG. 3. RAVINE ARRAY, DIAGRAMS OF FIBRES SELECTED TO SHOW THE ESSENTIAL FEATURES OF THIS ARRAY

a: Super-sickle-fibre, shed
b: Sickle-fibre with large sickle-end, shed.
c: Hairy sickle-fibre with large sickle-end, persistent, with crisis-thinning.
d: Fine sickle-fibre with large sickle-end.
e: Fine sickle-fibre with small sickle-end.
f: Hairy sickle-fibre with small sickle-end, persistent, with crisis-thinning
g: Sickle-fibre with small sickle-end, shed From the last fibre there is a direct transition to curly tip fibres hairy in the post-natal region.

It is to be noted, though this feature is not a universal rule in similar series, that the post-natal hairy region grown before shedding or crisis-thinning is longer in the hairy sickle-fibres with small sickle-ends, placed late in the series, than in hairy sickle-fibres with large ends, and in the super-sickle-fibre figured, placed early in the series.

The Ravine Array.—In this array (Fig. 3), as in Saddle, there is a transition from chalky sickle-fibres with small ends to chalky curly-tip fibres, but within the series of sickle-fibres, with sickle-fibres on the whole of medium size, are considerable numbers of fine sickle-fibres. The failure of these fibres to become coarse after birth is regarded, as intimated already, as an effect of the pre-natal check.

On these fine sickle-fibres, therefore, the pre-natal check has produced a marked effect. In wool specimens not unduly coarse that show this array, the check is to be looked upon as becoming powerful, but remaining so for only a short time in pre-natal development. In coarser-woolled specimens with this array we may suppose that the checking-force is really more powerful, but that, owing to the inherent coarseness of the fibres beginning to grow about the critical time, not many of them are kept down to a fine diameter

More is to be said about the shedding of chalky sickle-fibres later in this article ; a pre-natal check acting powerfully, there is reason to believe, tends to prevent shedding. In the Ravine array it sometimes happens that there are two well-defined groups of shed sickle-fibres, one with larger ends, the other with smaller ends. The follicles of the sickle-fibres of the first group may be regarded as having become well established before the check becomes intense, those of the second group as not having developed far enough to be exposed to the full force of the check. Accompanying both these groups of shed sickle-fibres, or associated only with the first group, are frequently fibres with a short thin region in place of shedding In consequence, as will readily be appreciated from what was said in this connection in the article on sickle-fibres, there are multitudinous differences in detail between Ravine arrays which it will be permissible to refrain from describing.

The Ravine array, while occurring in some very hairy specimens, is more common amongst those with the persistent birthcoat fibres not coarsely hairy.

The Valley Array.—In this array (Fig. 4) checked curly-tip fibres, followed along the array by coarser curly-tip fibres, are the key type. Many sickle-fibres, especially those standing later in the array, the ones with smaller ends, linked by transitional fibres with a mere suggestion of a sickle-end with the checked curly-tip fibres, are also fine, so that the total suppressing effects of the check on fibre diameter are pronounced.

Amongst variations in Valley arrays we may note—

(*a*) Differences at the beginning of the array.

Super-sickles remaining fine after birth are sometimes common in this array, being known also in some Ravine arrays. Here it would seem that the check has become intense especially early.

(*b*) Differences in the fineness of the part of the array most affected by the pre-natal check

In some arrays the sickle-fibres, and, it may be, the checked curly-tip fibres also, are conspicuously fine, and this when big curly-tip fibres are present as coarse as any in some Ravine and even Saddle arrays. The differences now under consideration are to be put down to differences in the intensity attained by the pre-natal check.

(*c*) Differences at the late end of that section of the array markedly affected by the pre-natal check.

Sometimes only curly-tip fibres with very many curls in the tip belong to the checked group. On the other hand, this group may also contain quite a number of fibres with appreciably fewer curls in the tip.

Clearly, therefore, there are differences in the stage of pre-natal development at which the powerful influence of the check subsides.

It has already been stated that this array is known in lambs with the coarsest curly-tip fibres quite hairy, but very many of the animals with this array on the back are fine-woolled and only slightly hairy in the fibres that escape the full force of the check by starting to grow relatively late.

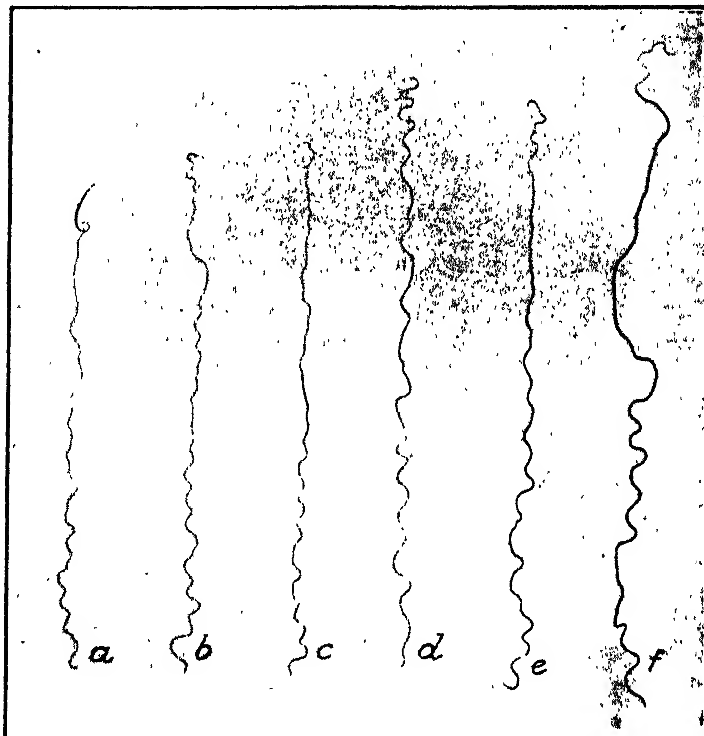

FIG 4. VALLEY ARRAY, DIAGRAMS OF FIBRES TO SHOW THE ESSENTIAL FEATURES OF THIS ARRAY.

a. Fine sickle-fibre with large sickle-end.
b. Fine sickle-fibre with small sickle-end.
c: Fibre transitional between fine sickle-fibre and checked curly-tip fibre.
d, *e*. Checked curly-tip fibres.
f. Peak curly-tip fibre, with relatively few curls in the tip, hairy after birth, as coarse as any persistent fibre in the array.
Fibres placed earlier and later in the array are not shown.

When fine sickle-fibres are present, and all the curly-tip fibres are quite fine, the array is called Plain. Such specimens show no more than negligible hairiness in the curly-tip fibres.

Variations in Hairiness in Terms of the Fibre Type Array.

To variations in detail in the characterization of the hairiness of the coat of the lamb there is no end. Of most of the featûres that vary and that are now to be considered some mention has already been made.

1. *Variations in the Type with which the Array begins.*—In accounts of this research it has been necessary to say so much about halo-hairs that rather little prominence has perhaps been given to the fact that many lambs are entirely free from halo-hairs on the back. In such specimens, too, there are often no super-sickle-fibres. When the array begins with sickle-fibres, chalky sickle-fibres may or may not be present. Not infrequently all the sickle-fibres are fine. Occasionally, though very rarely, it is stretching a point to call any fibres sickles. When anything approaching a sickle-end is barely existent we may consider the array to begin with curly-tip fibres.

There are two ways of regarding an array which lacks one or more major types at the early end. It may be that corresponding roots will grow one type of fibre in one animal, another in another, so that, as determined by certain undefined conditions, a given follicle may in one lamb give rise to a halo-hair, in another to a sickle-fibre. On the other hand, it is possible that in some lambs the coat is later than in others in beginning its development, in the sense that follicles capable of producing fibres standing at the beginning of the array are not founded at all. This question has received some attention from Miss Galpin and myself. It seems likely that both interpretations will have their use. It may be added, without discussing the matter further now, that for really fastidious breeding there will be a lot of things worth knowing about the beginning of the fibre-type array of a wool specimen free from halo-hairs.

2. *Variations in Hairiness irrespective of the Pre-natal Check.*—When a particular result is brought about by two different kinds of interacting factors it is a difficult matter to disentangle their effects. It is clear, however, that in different wool specimens there must be great differences, not only in the restricting effect of the pre-natal check, but in what may be termed the intrinsic or inherent coarseness and hairiness. A grossly hairy lamb, like those with the array Plateau, must be regarded as so coarsely hairy not because, or only because, the pre-natal check may be feeble, but for the reason that, apart from this, the lamb has it in it to grow excessively hairy wool.

Of this inherent hairiness we may distinguish the following aspects :—

(*a*) Variations in the maximum coarseness of hairiness of big fibres occupying a corresponding position in the array. This character may be judged more especially by the hairiness of the stoutest curly-tip fibres.

(*b*) Variations in the distance along the array to which hairiness extends, the fibres being judged by the region grown in the first two months or so after birth.

Sometimes all the curly-tip fibres are hairy, and, now and again, even some of the non-curly-tip fibres which evidently begin to grow later than the curly-tip fibres, the tips of the non-curly-tip fibres first passing through the skin around the time of birth. Generally, as we proceed along the curly-tip series, from the coarsest fibres with more curls in the tip to fibres with fewer curls in the tip, there is a marked reduction in hairiness. Sometimes, as mentioned in discussing the Plateau array, this drop in hairiness along the array is a sudden one. In the extreme condition, short of complete freedom from hairiness in curly-tip fibres, only a very few such fibres, with long tips, are hairy.

In fine-woolled specimens with none of the curly-tip fibres medullated, we are not in a position to say to what extent the fineness of the curly-tip fibres early in the series is due to the intrinsic fineness of the specimen, to what extent to the pre-natal check. Repeatedly in the study of mammalian hair it proves necessary to attribute the same effect to different causes, and in this instance there is probably truth in both these explanations.

The statement just made has reference to the Plain array. We must indeed be prepared for the existence of some Plain arrays which are not hairy, for the reason that they are intrinsically not hairy, because they have not got it in them to be hairy, whatever the pre-natal check. On the other hand, it is very likely that in other Plain arrays long-tipped curly-tip fibres would be somewhat hairy were they not prevented from being so by the pre-natal check. If animals with two Plain arrays differing in the way suggested were mated together, there is one obvious interpretation if their offspring should prove to have somewhat hairy long-tipped curly-tip fibres.

(*c*) Variations in hairiness along the length of the fibre.

Something has been said in earlier articles about differences in hairiness in corresponding fibres in passing from the tip to the butt of the staple. As pertinent to the shedding of chalky sickle-fibres, which is to be discussed later in this article, it may here be mentioned that if in the curly-tip fibres coarse hairiness is sustained clearly beyond the crisis level that is, further towards the butt than the length of a shed chalky sickle-fibre—then these sickle-fibres tend to shed less readily than otherwise It would seem that the inherent tendency to sustained hairiness shared by the follicles of the chalky sickle-fibres and curly-tip fibres enables many follicles to continue active when, otherwise, they would enter upon a dormant phase.

3. *Variations in the Kind of Pre-natal Check.*—The existence of these variations is evident enough from the description of the several fibre-type arrays, and especially from what has been said about the Valley array. When the comparison is between different arrays the contrast is greater. In animals in which the coarseness of the inherent hairiness, as judged both by fibres very early in the array and by coarse curly-tip fibres, appears to be much the same, we may detect differences attributed to variations in—

(*a*) *The onset of the check.*—To take an extreme condition, cited already, super-sickle-fibres remaining fine after birth may be very plentiful, or, on the other hand, all these fibres may become hairy after birth.

(*b*) *The intensity of the check.* — Fine sickle-fibres alone, or in company with checked curly-tip fibres, may or may not be found. When present they vary from slightly fine to especially fine.

(*c*) *The decline of the check.*—Even after the check has been intense, as testified by fine sickle-fibres, we may suppose it in a Ravine array rapidly to subside, or, at the other extreme, in some Valley arrays to cause quite a section of the series of curly-tip fibres, including those with the most curls in the tip together with others having appreciably fewer curls, to be finer than the stoutest curly-tip fibres which then occupy a position relatively late in the array.

The situation thus revealed is a complicated one, and it is not inappropriate that it should be so in the covering of that animal which produces the most valuable of mammalian coats. No little exercise is provided for our wits in winning the accurate knowledge needed for the exploitation of the fleece of the sheep. The details that have been accumulated, which are now linked together in one coherent story, supply an essential basis for future research, and especially for experimental work not only on hairiness, but upon the factors determining fleece-weight, or the effects of nutrition on the fleece. These somewhat elaborate details have besides direct bearing upon selection against hairiness, as will be made clear by the short account which follows of the main facts about the continued growth of kemp after the shedding of the halo-hairs.

The Fibre Type Array and Kemp in the Hogget Fleece.

This concluding section is a preliminary report upon one aspect of the present research that is put forward now in order to show the practical significance of the story of the fibre type arrays that has been related. The statement now made has reference to specimens from the back in which coarse hairiness in persistent birthcoat fibres is not sustained below the crisis level, there being evidence that such shedding interferes with the shedding of sickle-fibres. When such lambs with little shedding of sickle-fibres are taken into account the generalization now made is not contradicted, in that few of the halo-hairs are succeeded by kemps, but the fibres that follow them in the same roots tend to be distinctly hairy, reflecting the hairiness of the persistent birthcoat fibres.

When halo hairs fall out they are succeeded by other fibres which may be kemps, that is, rather short, very hairy fibres themselves shed in their turn; or they may be hairy, more so or less, of persistent growth; or they may be unobjectionable. The shed successors of halo-hairs are called secondary kemps to distinguish them from birthcoat kemps. In this matter of succession there are great differences between individual lambs.

A relation exists between the degree of hairiness and the shedding of the successors of halo-hairs and the extent to which the sickle-fibres with large ends have shed. The shed sickle fibres also are followed in the same roots by other fibres, which are scarcely ever shed, that are sometimes hairy, and in general run parallel, at a lower level, with the hairiness of the successors of the halo-hairs in the same specimen. With these fibres that succeed sickle-fibres we are not, however, now concerned.

The presence of a big proportion of secondary kemps amongst the immediate successors of halo-hairs is correlated with the shedding of a substantial majority, usually three-quarters or more, of the big-ended sickle-fibres. This free shedding of the big-ended sickle-fibres has been found in Saddle, Ravine, and Valley arrays, but in my material it has occurred more consistently in the Saddle arrays.

When the immediate successors of halo-hairs are shed, they again are followed by other fibres in the same roots, which may or may not be shed kemp, and to these again the same applies. If the

halo-hair follicle continues to grow kemps up to the time of the shearing of the hogget at about fourteen months, three such secondary kemps are sometimes grown, one after the other, in the same follicle. The usual number is probably two, when a third kemp-like fibre is often growing at the time of shearing. The extent to which the growth of kemp is continued throughout the growth of the first fleece can thus best be judged from the second "generation" of secondary kemp, the fibres which, counting the original halo-hairs, are the third occupants of their follicles. For studying succession, examination in benzol has been an extremely useful method.

In those lambs in which, on the standard back position, the growth of kemp is continued late in the first year in a fair proportion of the halo-hair follicles, not only have a big majority of the sickle-fibres with large ends been shed, but the fibre-type array has been Saddle, or the allied All-in array. In those specimens where much secondary kemp succeeds the halo-hairs, but in which the growth of secondary kemp is not continued in any abundance later in the year, the array has been Ravine or Valley.

There are reasons for believing that to produce a hairy fibre which is shed in a normal manner, after a certain growth period—that is to say, to grow a kemp—is a very vigorous thing for a follicle to do. Amongst other evidence it may be noted that the stoutest of birthcoat fibres, halo-hairs, are almost all shed, and that the super-sickle-fibres, with necks coarser than those of sickle-fibres, shed the more readily. There is evidence also that poor growth of the lamb in the first two months, accompanied by recognizable abnormality in the growth of the fleece, hinders the shedding of chalky sickle-fibres.

It may appear paradoxical that vigorous activity on the part of the follicle should lead to shedding. My interpretation is that if a follicle works extremely hard it is compelled to take a rest. On this view a series of very vigorous periods of fatiguing activity, separated by recuperating quiescent intervals, gives a succession of secondary kemps. After the first two or three months there is usually some reduction in the general vigour of the growth of the fleece, as evidenced by the usual reduction in the coarseness of hairy fibres, for hairiness, as explained in an earlier article, is also looked upon as the expression of vigour on the part of the follicle. With this reduction in vigour may be correlated the almost invariable failure of a sickle-fibre follicle to grow a secondary kemp. With hairy sickle-fibres it is clearly much more touch-and-go than with halo-hairs, whether they cease growth and fall out, or remain in the skin as fibres of persistent growth. The continued growth of a series of secondary kemps in a halo-hair follicle we are to regard as achieved in spite of the reduction in the general vigour of the growth of the fleece.

On the view put forward it is thus a vigorous thing for many big-ended sickle-fibres to be shed, and so it is for the growth of a series of secondary kemps to be kept up, one after the other in the same follicle, throughout the first year. These two performances run parallel. Now when the immediate successors of many halo-hairs are secondary kemps, then, if the array is Saddle (or All-in), a good deal of kemp continues to be grown later in the year. If, on the other hand, the array is Ravine or Valley, the growth of secondary kemp is

not kept up well later in the year. When the array is Saddle a weak pre-natal check is indicated, when Ravine or Valley a more powerful one. The more intense pre-natal check, it is concluded, has impaired the vigour of the halo-hair follicles sufficiently to prevent more than a few of them from growing secondary kemp late in the first year.

For this repeated production of secondary kemps, therefore, the essential condition is that the pre-natal check should not be powerful. Whether halo-hairs be abundant, scarce, or absent, the check may be weak or intense. In some specimens with few or no halo-hairs the fibre-type array, and the shedding of sickle-fibres, reveal just those conditions which, were halo-hairs present, would permit the growth of a series of secondary kemps. The significance of this from the point of view of breeding is obvious. Thus is demonstrated the practical consequence of the kind of fibre type array.

ACKNOWLEDGMENTS.

While this research has been in progress there has been co-operation between the College and the Department of Scientific and Industrial Research. The figures illustrating this article have been prepared by Mr. M. T. Gabriel.

THE CONTROL OF FLEAS.

THE following information is extracted from a statement which has been kindly supplied by Miss E A Plank, Entomologist, Dominion Museum .—

At the present time throughout New Zealand there appears to be what may be termed an epidemic of fleas which, although not likely to cause any outbreak of disease, occasion much discomfort and annoyance

The following control measures against an epidemic of fleas are suggested in a British Museum pamphlet by James Waterson —

(1) Moth-balls kept in one's clothes help to repel the insects from wearing-apparel.

(2) Oil of eucalyptus in sheets repels insects.

(3) Wash infected dogs and cats with good carbolic soap, rinsing well afterwards A 3-per-cent. solution of creolin (warm) has been used with excellent results Leave animal in for five to ten minutes, then wash in warm water and soap Care must be taken to clean the head.

(4) All cracks in floors and walls should be filled up or a solution of naphthalene (crushed moth-balls) in benzene poured down. (Care must be taken to avoid fires till benzene has evaporated.)

(5) In outbuildings rubbish should be burned and walls and floors should be washed down with some creosote preparation or a petroleum or paraffin emulsion. Such an emulsion when diluted with water (1 in 20 or even more) will kill all fleas that it touches on floors.

Emulsion.—Three parts of soft soap are thoroughly melted by heat in 15 parts of water and whilst still hot 70–100 parts of the oil (petroleum, kerosene, or paraffin) are added gradually with much shaking or stirring Note . The proper emulsification depends on the *gradual* addition of the oil and thorough agitation. The final mixture should be white and creamy with no free oil. Oil emulsions made with the light or more volatile oils are quicker in action and more penetrating than those made with heavy oils. They are, however, more rapidly dispersed by drying off and evaporation.

TOMATO-MOSAIC.

ITS APPEARANCE, CAUSE, AND PREVENTIVE TREATMENT.

E. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North

TOMATO-MOSAIC is a very troublesome disease in certain of the tomato-growing districts of New Zealand. Although it has probably been present in this country for many years it was not recognized as mosaic until 1924, when it was observed on glasshouse tomatoes in Nelson. It has since been noted in the Auckland, Poverty Bay, Hawke's Bay, Wellington, Canterbury, and Otago districts. Tomato-mosaic is of world-wide distribution, and has been recorded from Europe, North and South America, South Africa, and Australia. The disease occurs in this country on both glasshouse and field crops, but is more common on the former.

SYMPTOMS.

Two types of mosaic occur on tomatoes in this country. Mild mosaic is characterized by a dark- and light-green mottling of the leaves (Fig. 1), this mottling being most readily seen when the leaves are shaded or held up to the light. The leaves are usually smaller than the normal and sometimes show a puckered or uneven surface owing to the unequal rates of growth of the dark- and light-green areas. The plants themselves are slightly stunted (Fig. 2), the amount of foliage reduced, and the yield of fruit lessened. Leaf symptoms appear only on those leaves which develop after infection has taken place, so that plants which become infected late in the season show mosaic symptoms only on the new growth. The stems of infected plants may be less sturdy than those of healthy plants, but they retain their normal green colour. The fruit is not mottled or marked in any way.

Severe mosaic has much more pronounced symptoms. The leaves are small, mottled, and curled, and show small dark areas of dead tissue (Fig. 1). Dark streaks also appear on the stem. Plants infected in the seedling stage remain much stunted (Fig. 3), while those infected later in the season fail to set fruit on the upper trusses and many of the leaves die and fall (Fig. 4). Ripe fruit from infected plants often shows a pronounced yellow and red mottling (Fig. 5).

ECONOMIC IMPORTANCE.

Although mosaic has been observed in both glasshouse and field in most districts, it is only in the former that serious losses have been experienced. Mild mosaic, which is much the more common of the two diseases, has been observed to the extent of 100 per cent. in some glasshouses in Nelson, while 10 per cent. infection has been reported from Auckland.

Field trials to determine the effects of mild and severe mosaic on crop yield have been carried out at the Plant Research Station, Palmerston North. Sixty-five plants infected with mosaic at the seedling stage were compared with sixty healthy plants. The mild mosaic produced a distinct mottling of the leaves, and, although it did not

have much effect on the size or appearance of the plants, it reduced the average yield from 6·7 lb. in the healthy plants to 4·1 lb. in the infected. This represents a reduction in yield of 39 per cent.

The plants infected with severe mosaic were very much stunted and the fruit was small and mottled, none being marketable. The average yield per plant was reduced from 5·78 lb. in the healthy plants to 0·51 lb. in the infected plants, this representing a yield-reduction of 91·2 per cent.

CAUSE.

Tomato-mosaic belongs to a well-defined group of plant diseases known as plant viruses. These viruses are infective principles which are difficult to define, since they cannot be demonstrated by any of

FIG. 1 MILD AND SEVERE MOSAIC OF TOMATOES

(*a*) Leaf from healthy plant.
(*b*) Leaf from plant infected with severe mosaic.
(*c*) Leaf from plant infected with mild mosaic.

the known mycological or bacteriological methods. Thus they cannot be isolated and grown on artificial media, and they cannot be seen under the microscope. The proof of the virus nature of any disease consists of being able to reproduce the symptoms on a healthy plant either by transferring to it insects which have fed on the diseased plant or by artificially inoculating it with juice extracted from the diseased plant.

In other countries it has been shown that mild mosaic of tomatoes is brought about by the same virus as causes mosaic of tobacco (Walker, 1926; Schaffnit and Mueller, 1931; Ainsworth, 1933). Inoculation experiments and a study of the symptoms of tomato-mosaic on several hosts has shown that this is also true for the disease as it occurs in New Zealand.

Host Range.

Experiments carried out in the other countries show that the mild mosaic of tomatoes has a wide host range, most of the wild and cultivated Solanaceous plants being susceptible (Gardner and Kendrick, 1922 (*a*); Bewley, 1923; Schaffnit and Mueller, 1931). In experiments carried out at this Station both mild and severe mosaic were transmitted from tomato to tobacco, Cape gooseberry (*Physalis peruviana*), and black night-shade (*Solanum nigrum*). Of these hosts only tobacco shows

FIG. 2. MILD MOSAIC OF TOMATO.

Glasshouse-grown tomato-plants Healthy plant on left and mild mosaic-infected plant on right

a high percentage of infection in the field. The mild mosaic form is prevalent throughout the tobacco crops in the Nelson District, and in individual fields over 90 per cent. of infected plants have been observed. This disease also occurs on tobacco in the Auckland District. Specimens of Cape gooseberries infected with mosaic have also been forwarded to this Laboratory. In this country severe mosaic is not known to occur naturally on any host other than tomato, while mild mosaic has not been observed on black night-shade.

Factors affecting Control.

Spread of the Disease on the Hands and Pruning-knives.—The tomato-mosaic virus is very infectious, and it has been shown (Walker, 1926) that the juice extract from an infected plant may be diluted to 1 in 10,000 and still bring about infection. Although the virus can gain entrance to the plant only through wounds, the mere touching of a leaf with the fingers causes sufficient injury, by breaking the leaf hairs, to allow infection to take place. Infection is readily carried from diseased

FIG. 3. SEVERE MOSAIC OF TOMATO

Glasshouse-grown tomato-plants Severe mosaic-infected plant on left, healthy plant on right.

to healthy plants on the fingers or pruning-knives (Bewley, 1923). Experience at this Station has shown that the virus may be removed from the hands by thorough washing with soap and running water.

Transmission on the hands and pruning-knives appears to be the main method of dissemination in New Zealand, and field experiments have been carried out to determine the extent to which mosaic may be carried on the fingers. Eighteen healthy plants were pruned immediately after mosaic plants had been handled, and then after thoroughly washing

the hands, the laterals were removed from a further twenty-four plants. Of the former, seven of the eighteen plants developed mosaic, while of the latter all twenty-four plants remained healthy.

Dissemination by Insects.—The natural method of spread of most virus diseases is by means of insects. Overseas work has shown that several species of insects are capable of transmitting tomato-mosaic, and among these are the two aphides, *Macrosiphum gei* and *Myzus pseudosolani* (Hoggan, 1930). Both these aphides are plentiful in New Zealand, and the former is commonly found on tomatoes.

FIG. 4. SEVERE MOSAIC OF TOMATO.

Plant on left infected with severe mosaic comparatively late in the season. Plant on right healthy.

From observations made at this Station it would appear that the spread of tomato-mosaic in the field by means of aphides is not extensive. Of a plot of forty-eight healthy plants grown alongside plants infected with mild mosaic and others infected with severe mosaic not one developed mosaic. The aphides *M. gei* and *Myzus persicae* were plentiful on both the diseased and healthy plants during the early part of the season.

Transmission through the Seed.—Seed transmission of tomato-mosaic was recorded by Westerdijk (1910). Although later workers (Allard, 1916; Gardner and Kendrick, 1922 (*a*)) were unable to confirm this, her conclusions have been supported by the more recent work of Bewley

and Corbett (1930), who record seed transmission to the extent of 6 per cent. Berkeley and Madden (1932, 1933) have also recorded seed transmission of tomato-mosaic.

Glasshouse experiments carried out at this Station have shown that of eighty-four plants grown from seed collected from plants infected with mild mosaic five developed mosaic. From evidence obtained from observations in commercial glasshouses in the Nelson District it would appear that the use of seed from infected plants plays an important part in the carrying-over of infection from one season to the next.

Spread from other Hosts.—The only other host on which the disease occurs extensively is tobacco, and where both tomatoes and tobacco are being grown by the same grower every precaution should be taken not to transfer the disease from the one crop to the other.

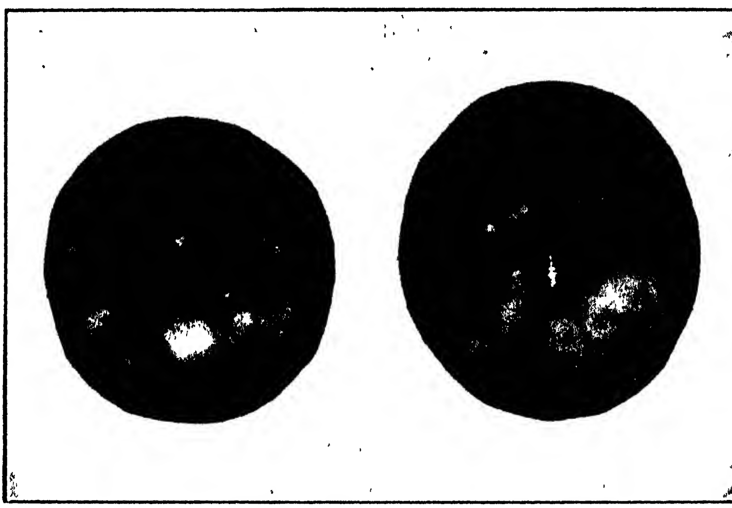

FIG. 5. MOTTLED FRUIT FROM PLANTS INFECTED WITH SEVERE MOSAIC

Cape gooseberries occasionally show mosaic, and with these plants there is an added danger for, being perennials, they are capable of carrying the disease over from the one season to the next, so that all infected plants should be removed. For this reason also they should not be allowed to grow as a garden escape in or about tomato crops.

Although mosaic has not been found to occur naturally on black night-shade, it is capable of infection, and since it sometimes lives through the winter in sheltered spots it may carry the disease over to the next season. Growers should therefore, during the winter, remove all black night-shade plants growing in sheltered places about the tomato-garden.

Transmission through the Soil.—Tomato-mosaic is systemic—that is, it is present in all parts of the plant, including the roots. The virus can withstand drying and remains viable in the juice extract from infected plants for at least 138 days (Walker, 1926). It would be expected from this that where the remains of infected plants are not

removed the virus might remain in a viable condition in the soil for some time. It has been shown by Doolittle (1928) that tomato-mosaic is capable of living in glasshouse soils for at least seventy days, and in field soils for from four to six weeks. Experiments carried out at this Station have demonstrated that the virus of the mild mosaic form from tobacco is capable of remaining viable for eighty days in soil contained in boxes and allowed to remain exposed to the weather.

It has been shown that the virus of tomato-mosaic is killed by exposure to a temperature of between 176° F. and 185° F. for ten minutes (Walker, 1926). Steam sterilization of the soil would therefore destroy the disease. That soil transmission is not necessarily the important factor in the overwintering of mosaic is shown by the fact that this disease is severe in Nelson glasshouses where steam sterilization is carried out every year.

Incubation Period of Tomato-mosaic.—There is an interval between the time a tomato plant becomes infected with mosaic and the time the first symptoms appear. This interval is known as the incubation period, and varies from six days in the summer when the plants are growing vigorously to three weeks in the winter when the plants are making little growth. During the latter portion of the incubation period the juice of the plant is infective and the plant is a potential source of infection. For this reason, when once mosaic has appeared in the crop, an interval of about fourteen days should be left between prunings. This gives an opportunity for all plants infected at the previous pruning to show the symptoms and to be removed before any of the plants are again pruned.

Masking of Symptoms.—Under shady conditions the symptoms of tomato-mosaic become less pronounced and sometimes late-season infection is scarcely perceptible. Owing to the danger of masking of symptoms it is unwise to save seed from tomatoes growing in a crop where mosaic is present.

The Effect of Fertilizers on Tomato-mosaic.—It has been shown by Brewer, Kendrick, and Gardner (1926) and Volk (1931) that various fertilizers—nitrogenous, phosphatic, and potassic—have no appreciable effect on the symptoms of tomato-mosaic.

Resistant Varieties.—Attempts to find varieties of tomatoes resistant to mosaic have so far failed (Gardner and Kendrick, 1922 (*b*); Bewley, 1925).

PREVENTIVE MEASURES.

(1) Save seed only from crops entirely free from mosaic.

(2) Do not plant out infected seedlings.

(3) Inspect plants periodically and remove infected plants immediately.

(4) Once mosaic appears do not handle the plants more than absolutely necessary. If possible, allow a fortnight to elapse between prunings.

(5) If mosaic has become too prevalent to allow infected plants to be removed, always work with the healthy plants before touching the diseased.

(6) Do not touch healthy tomato plants after working with mosaic-infected tomato, tobacco, or Cape gooseberry plants without first thoroughly washing the hands with soap and running water.

(7) If a crop has shown infection, remove all plants, with roots attached, as soon as possible after the season is completed and burn them.

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Limited Use for Subterranean Clover.—Subterranean clover is particularly adapted for growing on light soils for the reason that such soils usually dry out badly in the late summer or early autumn, and as it is only an annual the original plant dies just about this time, but meantime it has produced seed which comes away as soon as the autumn rains occur. As soon as the small white flowers are formed they begin to turn their heads towards the soil, and the seed, having matured, is actually pushed into the soil. Thus its life's cycle is completed and the original plant dies. The planted seed re-establishes as soon as the soil is sufficiently moist. In such situations white clover may die out or at best remain in a very stunted non-producing form. Subterranean clover thus produces its maximum growth during late autumn or early winter and again during early spring until the dry weather sets in, so that if dependence is placed upon it one is left without any clover in the pasture for probably a few months during summer and autumn. This explains why it is generally recommended for light soils. There is no reason why subterranean clover would not do well on heavier land. As a matter of fact, it does well on good moist soil, but it is generally agreed that white clover is much superior on such land and provides feed much more uniformly throughout the year than subterranean clover. Subterranean clover very quickly establishes itself through reseeding, and within a few years usually becomes dominant in a pasture. One should not expect to kill out subterranean clover by heavy stocking for the reason already explained—*i.e.*, the flowers are not prominent and the majority succeed in reaching the soil-surface and planting their seed in spite of stocking.

PIG-MANAGEMENT AND ITS RELATION TO DISEASE.*

* Portion of an address broadcast from radio station 2YA, Wellington, April, 1934

D. MARSHALL, Veterinarian, Department of Agriculture, Hamilton

IN view of the increasing importance of pig-raising in New Zealand, there appears need for greater attention to methods of feeding and management.

In the Waikato district during several seasons in which there have been numerous opportunities of investigating disease and losses amongst swine it has been found that in many cases these can be ascribed largely to defects in feeding, and more particularly to neglect of certain elementary principles of management. Too often, in an attempt to increase production, the pig population on the farm has been increased by several sows, and later, by their progeny, while the original sties, contaminated and often out of date, and dirty yards, continue to do duty.

Some old-established pig feeders and breeders have undoubtedly developed an efficient system providing for clean runs and sufficient scope for their pigs, as well as feeding methods which prove satisfactory. Under these conditions there is usually almost complete freedom from disease. In far too many other instances, however, available knowledge appears to have been overlooked or ignored. Advice is sought after considerable loss has occurred, and it is frequently found that pigs are being kept under such conditions as to make disease almost inevitable. In such cases the first step to be taken towards improvement is to provide entirely new runs. Swine-fever, which had not been present in New Zealand for a long period prior to last year's outbreak in the Wellington Province, was effectually stamped out in May With this exception, most losses are from bacterial causes, becoming active only when the pig's resistance and vitality are lowered.

FACTORS AFFECTING VITALITY.

Among factors tending to reduce vitality may be enumerated : —

Overcrowding.—This leads to jostling and fighting at feeding-times, with production of small wounds about the feet and elsewhere ; and also to too many pigs sleeping in one house, rendering it stuffy ; likewise to heavier dung contamination of yards, and more rapid cutting-up of surface in bad weather.

Dirt.—Mud and filth in yards and round feeding-places is soon contaminated by droppings, possibly from diseased pigs, and hence by germs and by eggs of parasites. The filth is necessarily carried into troughs by pigs' feet, and is also in contact with any wound or sore. Dirty feeding-places are very undesirable. One often sees pigs with an excellent free range over grass paddocks, undoing much of the benefit of this by coming to a filthy and contaminated feeding-place. In hot weather pigs are anxious to wallow, and access for this purpose to dirty drains from cow-sheds or pigsties should not be allowed. Dirty yards especially are a menace to suckers and young weaners, as they will

succumb at this period (four to ten weeks) to conditions under which older pigs may remain healthy. It is therefore a mistake to allow sows with suckers to run about with others in a common yard, or to let weaners feed and mix indiscriminately with older pigs.

Damp or draughty sleeping-houses, or draughty sleeping-places under open-bottomed trees or hedges, may lead occasionally to lung trouble.

In the winter and spring a sudden drop in the temperature or exposure to cold winds has been followed by disease, indicating the need for adequate housing and protection from prevailing wind, particularly at this period.

A general point frequently and forcibly brought to notice is the importance of isolating fresh purchases for about ten days so that any latent disease which develops and becomes evident as a result of temporarily upset caused by transport to and from sales, and possible changes of feed, may be confined to the newly purchased animals and not spread to the herd.

Feeding.—Feeding is a most important factor in maintaining disease-resistance in the pig as in other animals. One must consider the routine of feeding, including the amount and number of feeds per day, physical nature of the food, its chemical composition, completeness, and ability to meet the demands of the animals being fed—whether newly weaned rapidly growing slips, pregnant sows, or baconers. Freedom from irritating qualities likely to upset digestion either directly, or, in case of suckers, indirectly by way of the mother's milk, must be guarded against. One has seen a type of scours in piglets due almost certainly to rich young grass on which sows were grazing It is proposed to discuss feeding somewhat briefly from the above aspects.

General Considerations about Feeding

Food taken in should include the proper amounts of protein, carbohydrates, and fats, the requisite minerals and vitamins, and sufficient, but preferably not excess, water.

Proteins have a somewhat complex structure. They contain nitrogen, and are necessary for building up the tissues in growing animals and for repair of waste. During digestion the protein molecule is broken down into the constituent amino-acids. There are many of these, some being essential for life and growth. Though a food may be rich in protein it may not contain these amino-acids which are essential, and thus it is unsuitable as the sole source of protein The importance of variety in the diet is thus seen. Milk contains over twenty amino-acids, and is believed to be a complete protein food This partly explains why the addition of even small amounts of milk to other diets for growing animals produces at times increased growth out of all proportion to extra amount of food.

Much of the protein of milk is removed in cheesemaking. Henry and Morrison give the comparative analyses as—

	Skim-milk.	Whey.
Protein	3·8 per cent.	0·8 per cent.
Fat	0·2 per cent.	0·3 per cent.
Sugar	5·2 per cent.	4·8 per cent.
Nitrogenous ratio ..	1 to 1·5	1 to 6·8

Skim-milk is a valuable article of the young pig's diet. It is questionable, however, whether feeding of unlimited amounts of skim-milk without supplement is a sound principle.

Sources of protein available for pig-feeding are: Skim-milk, meat and meat-meal, good-quality short-growing pasture, meals such as pea or bean meal.

Carbohydrates include starches and sugars (and also fibrous portions of grass and plant products generally — the former somewhat poorly digested by pigs). They produce energy for the work of the body, heat during cold weather, and any excess is stored up as fat. Carbohydrates are available to pigs in the form of starches in grains such as maize, pollard, and barley; in the roots such as potatoes and artichokes, &c.; and in the milk-sugar of milk and whey. A useful carbohydrate is molasses, which might with advantage be more often fed with skim-milk, since it counteracts constipation and, according to recent work by Dr. Cunningham, of the Wallaceville Veterinary Laboratory, contains a considerable amount of lime in a very assimilable form. Carbohydrate in excess may produce an unduly fat carcass. The type of food influences the nature of the fat.

Fats.—Fats are utilized in much the same way as carbohydrates. They produce proportionately more energy. They are present in seeds (*e.g.*, linseed), the butterfat in milk, in meat-meal as animal fat, in certain fish-oils. The last have undesirable odours which may be carried over into the body-fat of the pigs, and stored, producing taint. Taint, of course, may result from other objectionable foods such as rabbit-meat.

Minerals.—On normal feeding and with a free range pigs will probably obtain sufficient minerals, but with confinement and artificial feeding, unless the mineral content is considered and adjusted, there may be a shortage. According to investigators, those minerals most likely to be deficient are lime and phosphate, possibly salt and iron compounds. Sows' milk is much richer in lime than cows' milk. Orr estimated that a three months' old pig required ⅓ oz. of lime per day. Sheehy estimated that if a pig receives half a gallon of separated milk per day lime need not be added. However, one has seen bone lesions in pigs where skim-milk in large amounts was being fed. For the proper absorption of the lime from the diet the presence of vitamin D is necessary, or else free exposure to the sunlight. Further, the lime and phosphate must be in reasonable proportion to each other. Failure to utilize lime from skim-milk, therefore, may be due to confinement from sunlight together with complete removal of all vitamin D with the butterfat. It would then seem advisable to include a certain amount of air-slaked burnt lime or finely ground carbonate in the diet, and to provide the requisite vitamin by free range in sunlight or by the addition to the food of cod-liver oil.

Phosphates are plentiful in cereal grains and in young pasture, but may be deficient in roots. In winter feeding on roots and meat-meal a certain amount of bone-meat should be added unless this is already present as meat and bone meal.

Iron deficiency, resulting in anæmia, has been reported in the United States of America and Britain to occur in suckers confined to

houses and rarely in those with free range. While access to soil may provide sufficient iron in many countries, we do know that there are parts of New Zealand, not yet all defined, where this might not apply. Therefore, the supply of a trace of iron in the form either of limonite or citrate of iron to small pigs seems advisable. Liver-meal or blood-meal would equally supply this mineral. Cows' milk contains only most minute traces of iron.

Salt is, we know, necessary, but pigs are, under certain conditions, susceptible to salt poisoning, and the method of supplying salt must be studied. About ¼ oz. daily is sufficient for a three-month pig, and it is probably better to supply this in solution in the slop feed rather than allow access to unlimited amount. Whey-fed pigs will get sufficient from the whey.

Iodine, though essential, is probably always present in sufficient amount. Sheehy and Senior, from their experiments, concluded it was unnecessary to supply additional iodine to pigs, though remarkable results have been reported as following regular dosage with it. It has been the writer's practice to advise iodine in small amounts to pregnant sows, particularly in the winter. Half an ounce of potassium iodide in 1 pint of water and one teaspoonful of this solution supplied in the sow's slop daily for about a month in the pregnant period will provide about 1½ grains a day, which should be ample.

Vitamins.—These are known as accessory food-factors. They are essential to life, but it has been considered that animals under ordinary conditions obtain ample. Two particularly concern us here: Vitamin A is found in butterfat, cod-liver oil, green vegetables, &c., and is necessary for growth and to protect against bacterial infection. In skim-milk much of this vitamin has been removed with the butterfat. To ensure adequate supply for young animals either some whole milk, fresh green vegetables (good grazing), or cod-liver oil should be supplied. Vitamin D, as previously mentioned, is concerned in the assimilation of minerals—*e.g.*, lime and phosphates. Free exposure to sunlight will largely replace the necessity for this vitamin in the food, since the animal can then manufacture its own. The value of sunlight may be much less than in the winter-time as it has been noted that the amount of both A and D in whole milk are much less in winter than in summer under ordinary conditions. Cod-liver oil cannot be used indiscriminately owing to the danger of taint in animals soon to be used for meat. In the case of pregnant sows and young pigs, or weaners, this does not apply. The use of small amounts, say ¼ oz. to ⅛ oz. daily, of cod-liver oil as a source of both vitamins A and D to pregnant sows in the winter and to early spring weaners seems advisable. This is followed in Swedish practice. Its use to similar stock later in the season would depend on the amount of young green feed and of sunlight available.

A word as to grazing. Good-quality short pasture, especially if containing clovers, is valuable feed for pigs. It contains considerable protein, comparatively good amount of phosphate, and is a source of vitamin A. Information collected by Mr. Peirson, Recording Officer of the Waikato Pig Recording Club, showed that in 131 pigs in fifteen trials, with good grazing available, an average of 2½ lb. more increase in live weight was put on in fifty-six days with less milk and meal than in a comparable number with poorer grazing. In other words, 2,520

gallons of milk and 47 lb. of meal produced 100 lb. live-weight increase on good grazing, while on poor grazing 3,120 gallons of milk and 49 lb. of meal were required for 100 lb. live-weight increase. A run full of weeds, however, must not be regarded as "grazing," and cocksfoot or rye-grass 2 ft. high, while it may provide some shade and shelter, is not suitable as a food. Grass in runs, therefore, must be controlled either by sheep or yearling cattle, or by mowing. There is great tendency for the rye to become coarse and rank owing to heavy manuring, and lime should be applied frequently, while it may be necessary to take an occasional crop of roots off the area.

SUMMARY.

Recommendations based on the facts discussed above may be summarized as follows :—

Provision of clean runs with grazing, changing locality from time to time, as necessary.

Avoidance of filth around feeding-places.

Provision of suitable houses or shelters, free from damp and draught.

Avoidance of overcrowding, particularly in houses or at feeding-places.

Provision of a balanced diet as varied as possible, and including a little bone-meal or lime, and green stuff.

In winter and early spring allowance of a little cod-liver oil to pregnant sows and young weaners

Isolation of recent purchases for at least ten days

SUPERPHOSPHATES AND CHEMICAL FERTILIZERS.

THE statistics presented hereunder in connection with the superphosphate industry have been extracted from the *Monthly Abstract of Statistics*, and show that more activity was evidenced by this industry in 1932–33 than was the case in the two previous years. For the year 1932–33 eight works reported operations, as against seven in 1931–32 The total cost of materials used advanced by 29 per cent., and the total value of products rose by 25 per cent

The following table gives an analysis of the quantities and cost of materials used during the last three years :—

—	1930-31.	1931-32.	1932-33.
Quantities			
	Tons.	Tons.	Tons.
Rock phosphate	141,686	139,544	185,658
Sulphur	24,846	25,022	35,265
Nitrate of soda	919	1,031	1,322
Potash	598	194	460
Total Cost.			
	£	£	£
Rock phosphate	369,511	379,770	471,311
Sulphur	160,080	175,378	272,947
Nitrate of soda	11,264	12,653	16,997
Potash	4,720	1,621	3,964
Other (including bags)	144,680	138,623	149,143
Totals	690,255	708,045	914,362

THE MISUSE OF LIME ON BUSH-SICK LANDS.

(Abstract.)

B. C. ASTON, Chief Chemist, Department of Agriculture, Wellington.

THE field experiments in connection with bush sickness which were started over twenty years ago gave an emphatic negative answer to the question whether it was necessary to use lime on the pastures of coarse pumice soils of the type technically known as sandy silts and all coarser types. Not only was there no response by the pasture to lime applied as a top-dressing, but animals grazed on limed land became bush sick sooner than on land to which no treatment had been applied. This information has been disseminated by means of this *Journal* from 1912 down to the present day, and a warning is here repeated with the added authority of recent experiments with lime on a variety of soils. Mr. C. R. Taylor, Analyst's Assistant at Rotorua, as the result of his inquiries, reports that lime alone applied as a top-dressing for pumice soils produces a pasture more unpalatable and drier in appearance than that on the untreated plot, while generally speaking lime and superphosphate mixture gives an inferior result to that from superphosphate applied alone.

The experience of other countries is interesting in connection with the reliability of certain laboratory tests in indicating whether a soil requires lime or not. The New Zealand experience of the coarse pumice soils is that field experiments do not bear out the need for lime indicated by laboratory tests universally used to determine the amount of lime required and the amount of sourness or acidity present in the soil. The British experience is somewhat similar with regard to certain fertile soils in Wales, Scotland, and Northern Ireland. Here the soil particles are coarse and are more akin to the parent rock than are those of the mature type of soils found in England, and although laboratory tests for acidity and lime requirement show that lime is needed and that no carbonate of lime is present, applications of lime do not improve the crops.

The results of certain laboratory tests as correct guides to liming will therefore have to be neglected when certain soils are the subject of experiment. As it is feared that the results of these unsatisfactory methods in the hands of analysts inexperienced in pumice soils may lead to the giving of wrong advice to farmers, the warning *Do not lime the pasture of bush-sick pumice lands* is again issued.

ANALYSIS OF LIMING MATERIALS.

THE Chief Chemist advises that copies of a new form to be filled in by farmers submitting samples of limestone, ground lime, or other liming material for analysis may be obtained from the Fields Instructors in the various districts or from the Chief Chemist, General Post Office, Box 40, Wellington. One form should be filled in for each sample, except where several samples of limestone rock from the same farm are forwarded, when one form will generally suffice. In future, samples will be analysed (free of charge to *bona fide* farmers) only if taken in accordance with the instructions and accompanied by full particulars set out on form Ag. H./6 4

CERTIFICATION OF SEED POTATOES.

PROVISIONAL CERTIFICATES ISSUED FOR SEASON 1933-34.

PROVISIONAL certificates are issued with the object of affording growers some indication of the general standard of their crops and assisting them in the disposal of their seed. Certification tags to be attached to the sacks are issued later, provided that an officer of the Department of Agriculture inspects the graded seed potatoes and is satisfied that they are still of the same standard of purity and freedom from disease as was indicated by the field inspection.

Each crop has received a group number, which indicates as accurately as possible the merits of its produce for seed purposes in relation to the merits of the produce of the other provisionally certified crops of the same variety. Group 1 is the highest and Group 10 the lowest. The difference between any two consecutive groups is small, and in making comparisons the cost of seed and transport should receive consideration.

Crops are also divided into two classes—namely, (1) Certified "Mother" seed; (2) Certified Commercial seed. Areas sown with certified mother seed are eligible for entry into certification. Areas sown with certified commercial seed are not eligible for entry into certification, except in cases where the seed planted has been raised by the entrant (grower) himself. Growers who intend to purchase seed with the object of entering certification must therefore purchase certified mother seed.

LIST OF GROWERS.

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP.			
Mother Seed—			
Adams Bros, Sheffield	3	..	4
Armstrong, P L., Fernside, Rangiora	3	..	5
Barnett, A, Leeston	2	..	2
Barnett, R., Dunsandel	3	..	4
Barratt, W H., Springlands, Blenheim	3	0·4	3
Caldwell, G., R.M D., Courtenay	1	..	1½
Carroll, A. D., R.M.D, Southbridge	1	..	6
Carroll, J., R M.D., Southbridge	2	..	3
Cross, A E., Pine Farm, Bennett's via Rangiora ..	1	..	1
Crump, F., R M.D, Springston	2	..	3
Crozier, W. J., Mt. Hutt, R.M.D., Rakaia ..	2	..	2
Dyer, H., Southbrook	2	..	3
Government Pure Seed Station, Box 4, Lincoln ..	2	..	1
Ham, A., Grovetown, Blenheim	3	0·4	1
Hegan, J., and Son, Southbrook	3	1·2	5
Henderson, G., R.M.D, Courtenay (Line A) ..	2	0·6	1
Henderson, G, R.M D, Courtenay (Line B) ..	3	0·6	2
Heron, F, R.M.D., Rangiora	3	0·8	15
Jellie, J., Russley Road, Fendalton, Christchurch..	2	..	2
Kavanagh, D, 50 Ryan's Road, Riccarton, Christchurch	3	..	1
Kenyon, F., Mina, North Canterbury	1	..	1
Marshall, D., R.M.D., Leeston	3	0·2	5
Martin, W. E., R.M.D., Kaiapoi (Line A) ..	2	..	3
Martin, W. E, R.M.D., Kaiapoi (Line B) ..	3	..	7
Morgan, D., Cheviot, North Canterbury	2	..	5
McPhail, W. A., Mitcham, via Rakaia	3	0·3	3
Nicklaus, J. F., 104 Ryan's Road, Fendalton, Christchurch	3	..	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Mother Seed—continued—			
Oakley, W., R.M.D., Halkett	2	..	6
Oliver, W. R., Hororata	2	..	1
Petrie, H. H., R.M.D , Swannanoa (Line A) ..	2	0·3	4
Petrie, H. H., R.M.D., Swannanoa (Line B) ..	2	0·6	5
Petrie, J., jun., R.M.D., Swannanoa	2	..	9
Petrie, J., sen , R M D., Swannanoa	2	0·2	5
Poulton, A. D., R.M.D , West Eyreton	2	0·3	5
Prosser, L. W., R.M.D., Leeston	3	..	5
Rathgen, A E , R.M.D., Leeston . ..	3	..	5
Redmond, C , R.M.D , Kimberley	3	..	12
Roper, P. F , R.M D., Halkett	2	..	3
Roper, R S , R.M D., Halkett	2	1·2	3
Royds, R. S , 12 Burnside Road, Fendalton, Christchurch	3	..	7
Ryan's Estate, R.M D , Springston	3	..	3
Swanson, W , Selwyn	3	0·6	3
Thomas, J W., Gray's Road, Fendalton, Christchurch	2	.	1
Westaway, R J , R.M.D , Courtenay	3	0·6	6
Wolff, R. G., R M D , Horrelville	2	..	3
Wright, L T , Annat	2	..	4
Commercial Seed—			
Adams, K and R , Sheffield	5	..	4
Anderson's Estate, Ladbrook's	4	..	3
Berryman Bros , 88 Winter's Road, Papanui, Christchurch	6	..	3
Breitmeyer and McFarlane, Little River.. ..	4	..	3
Crawford, A. W., 140 Belfast Road, Belfast ..	4	..	3
Crawford, J. M , Belfast Road, Belfast	4	0·6	3
Eder, W , R M.D., Sefton	6	..	15
Ferguson, J W , R M D , Winchmore	6	0·1	2
Guthrie, W R., 34 Guthrie's Road, Belfast ..	4	..	3
Gaffeney, Mrs. M. F., Temuka	6	0·6	1
Gray, J. L , St. Andrew's	6	..	3
Gray, R , St Andrew's	4	..	6
Guy, T. A. and E. B., Yaldhurst	4	..	2
Haines, C., 108 Waimakariri Road, Christchurch ..	6	..	2
Kelleher, T., Pleasant Point, Timaru	6	..	4
King, W. H., Rosewill, R D., Timaru	6	..	2
Martin, A., Box 42, Morven	5	..	4
Miller, G , Seadown, Timaru	4	..	1
Moore, H. S., Box 4, Kaiapoi (Line A)	4	..	4
Musgrove, G , Meadows, Washdyke	4	0·2	1
Musson, W., Rangiora	4	0·6	4
McCaw, W T., Tycho, South Canterbury ..	4	..	2
McDermott, E C., Spreydon	4	..	9
McKenzie, J. R , Yaldhurst	4	0·3	8
Nairn, G , R.M D., Lakeside	7	0·3	3
Oliver, J. O. J., Temuka	6	..	1
Porter, E., St Andrew's	5	..	3
Porter, E. G. Y., St. Andrew's	4	0·7	5
Rangiora High School, Rangiora (Line A) ..	6	..	1
Rangiora High School, Rangiora (Line B) ..	4	0·5	1
Rich, A. J., R.M.D., Kaiapoi	5	..	15
Schaffer, F. L., R.M.D., Springston	4	0·2	6
Seivwright, R. M., Meadows, Washdyke	4	0·3	3
Seyb, L., Washdyke, Timaru	6	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Commercial Seed—continued			
Simpson, F. F, Morven (Line A)	7	..	2
Smith, E. A., R M.D., Springston	5	1·8	25
Smith, G. G., R.M D, Broadfields	4	0·5	2
Spillane, A., River Road, Temuka	7	..	1
Timaru Boys' High School, Timaru	7	..	2
Topham, J. W., Arowhenua, Temuka (Line A) ..	6	..	1
Topham, J W., Arowhenua, Temuka (Line B) ..	6	..	1
Watson, R G and L. J., Springbank, R M D, Rangiora (Line A)	4	..	1
Watson, R G and L. J., Springbank, R.M.D, Rangiora (Line B)	6	0·6	2
Weeber, H, Englefield Road, Belfast	4	..	5
Wilson, M., R.M D., Halkett	4	0·2	2
Wilson, W., 279 Lincoln Road, Halswell ..	4	..	3
DAKOTA.			
Mother Seed.			
Adams Bros, Sheffield	6	..	1
Allen, A., R.M D, Leeston	4	..	11
Bower, M Spencer, "Claxby," Swannanoa ..	5	..	1½
Campion, C A, Highbank, Methven (Line A) ..	6	..	7
Chambers, A J, "Carberry," Weedon's.. ..	5	..	5
Chambers, L J, "Carberry," Weedon's.. ..	4	..	2
Chambers, R, Rolleston	5	..	5
Crozier, W. J, Mount Hutt R M.D, Rakaia ..	6	..	6
Gardiner, C, Mitcham, via Rakaia	5	..	4
Gardiner, O J, Dunsandel	5	..	8
Good, A, 133 Matson's Road, Papanui, Christchurch	5	..	1½
Government Pure Seed Station, Box 4, Lincoln ..	3	..	2
Hill, L. F., R.M D., Eiffelton	5	..	5
Johnston, H. W., Dunsandel	5	..	5
Johnston, R H., Dunsandel	5	..	2
Jowers, G C, R.M D., Springston (Line B) ..	5	..	3
Kavanagh, D, 50 Ryan's Road, Riccarton, Christchurch	5	..	1
Kokay, S., Tuatapere	6	..	1
Marshall, D, R M D, Leeston	3	..	5
Morrish, F. E, Springston	6	..	3
McKenzie, J R, Yaldhurst	5	..	5
McPhail, W. A, Mitcham, via Rakaia	6	0·4	10
Nicklaus, J. F, 104 Ryan's Road, Fendalton, Christchurch	6	..	1
Petrie, J., jun, R M.D., Swannanoa	6	..	9
Petrie, J., sen, R.M D, Swannanoa	6	..	5
Rolston, G, R.M.D, Weedon's, Courtenay ..	5	..	9
Royds, R S., 12 Burnside Road, Fendalton, Christchurch	4	..	1
Ryan's Estate, R.M D., Springston	5	..	1
Seymour, J, Hawthornden Road, Christchurch ..	4	..	5
Shellock, W., R.M.D., Te Pirita, Rakaia.. ..	4	..	2
Steele, J, R.M.D., Kimberley (Line A)	5	..	1
Thomas, J W, Gray's Road, Fendalton, Christchurch	5	..	1
Tweedy, S., R.M.D., Dunsandel	6	..	7
Walker, C. E., R.M D., West Melton	6	..	12
Wilson, M., R.M.D., Halkett	6	0·2	5
Wolff, R. G., R.M.D., Horrelville	6	..	5

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
DAKOTA—*continued.*			
Commercial Seed :—			
Anderson's Estate, Ladbrook's	7	..	2
Berry and Halliburton, 28 Dundas Street, Christchurch	8	..	5
Boag, R. A., R.M.D , Greendale	7	..	3
Burnett, J. N , Templeton	7	..	2
Burrowes, J., Mount Hutt R M D , Rakaia ..	8	..	11
Campbell, D., King Street, Rangiora	8	..	2
Carpenter, A M. and F., Fernside, Rangiora ..	8	..	4
Cockburn, A., R.M.D., Courtenay	8	..	1
Crawford, A. W., 140 Belfast Road, Belfast ..	8	.	1
Cross, A E., Pine Farm, Bennett's, via Rangiora ..	8	..	3
Cross, H E., R.M D , Weedon's, Courtenay ..	7	..	5
Cross, S., R.M D , Weedon's (Line A)	8	..	1
Curragh, J , Templeton	7	..	2
Ellmers, J W , Kaiapoi	7	..	2
Foster, T. C , Ladbrook's (Line B)	7	..	8
Foster, T C., Ladbrook's (Line C) .. .	7	0·3	7
Giles, N , Seadown, Timaru (Line A)	8	..	1
Giles, N., Seadown, Timaru (Line B) .. .	7	..	2
Gray, R , St. Andrew's	7	..	3
Green, J , Glenitı, South Canterbury	8	..	1
Ham, A , Grovetown, Blenheim	7	0·4	1
Jowers, G C , R M D , Springston (Line A) ..	8	..	2
King, W. H , Rosewill R M.D , Timaru	7	..	1
Mee, J. P D , Levels	7	..	1
Miller, G , Seadown, Timaru	7	..	1
McIntosh, H J , Kaiapoi	7	..	4
Oakley, J T., R M D , Eiffelton (Line A) ..	8	..	1½
Pannell, W. B , R.M D., Rangiora	7	..	2
Philp, F , Seadown, Timaru	7	..	1
Robson, F H , Box 22, Lincoln	7	..	8
Ryan, P F , R M.D , Springs-Weedon's	7	..	10
Scivwright, R M , Meadows, Washdyke ..	8	..	1½
Skurr, J E , Sheffield	8	..	1
Steele, J., R.M.D., Kimberley (Line B)	7	..	3
Stowell, D , St Andrew's	7	..	4
Ward, W J , Ohapi, Temuka	7	..	1
ARRAN CHIEF			
Mother Seed :—			
Bennett, T A., Te Tua, Southland	3	0·8	3
Griffin, J. G., Te Waewae, Southland	1	..	2
Hayman, Mrs. F., Willowbridge (Line D) ..	4	..	1
Henderson Bros., Otapiri R.M D., Winton (Line A)	3	0·6	1
King, R. M., Box 102, Tuatapere	2	0·3	4
Knowler, C. E., Tuatapere	2	1·1	3
Knowler, H , Te Waewae, Southland	1	0·6	5
Knowler, H. C., Te Waewae, Southland	1	..	4
Mehrtens, L C., Box 27, Tuatapere	1	..	1
McCarthy, E., Prebbleton	3	..	1
Poninghouse, W. L., Tai Tapu	4	..	1½
Robinson, R. G., Box 4, Papanui, Christchurch (Line A)	4	..	1
Robinson, R. G., Box 4, Papanui, Christchurch (Line B)	3	..	1
Saunders, E. E., Studholme Junction (Line C) ..	4	..	1
Teschner, C. A., Chatton Road, Gore	4	0·3	1
Wright, L. T., Annat (Line A)	4	..	11

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
ARRAN CHIEF—*continued.*			
Commercial Seed.—			
Barclay, G. M. M., Riverside Road, Waimate ..	6	..	6
Barnett, A. W., Box 2, Morven (Line A) ..	5	0·3	1
Barnett, A. W., Box 2, Morven (Line B) ..	6	..	4
Bell, J. F., Stirling (Line A)	5	1·6	5
Borstal Institute, Invercargill	5	1·0	6
Brown, A. F., 287 Withell's Road, Riccarton, Christchurch	5	..	2
Campbell Bros., Waituna, Waimate	5	..	2
Campbell, P., Studholme Junction	5	0·2	1
Cox, S., Box 9, Willowbridge (Line A)	5	..	2
Cox, S., Box 9, Willowbridge (Line B)	5	..	3
Fletcher, W. J., Willowbridge	7	..	3
Frazer Bros., Southbrook	5	..	1
Gray, J. L., St. Andrew's (Line A)	6	..	1½
Gray, J. L., St. Andrew's (Line B)	6	0·5	9
Harris, J., Meadows, Washdyke	6	..	1
Hayman, A. B., Willowbridge	5	..	3
Hayman, Mrs. F., Willowbridge (Line A) ..	5	..	8
Hayman, Mrs. F., Willowbridge (Line B) ..	5	..	5
Hayman, Mrs. F., Willowbridge (Line C) ..	5	..	2
Henderson Bros., Otapiri R.M.D., Winton (Line B)	5	0·3	1
Henshaw, F. J., Studholme Junction (Line A) ..	6	..	2
Hewson, R. W., Seadown, Timaru	6	..	3
Leathwick, A., Hunter R.M.D., Waimate (Line A)	6	..	1½
Leathwick, A., Hunter R.M.D., Waimate (Line B)	6	0·2	1½
Poulsen, C. H., Styx Nurseries, Tombs Road, Christchurch	5	..	1
Reid, W. P., Maheno, via Oamaru	6	0·7	4
Robinson, R. P., Waikuku (Line A)	5	..	1
Robinson, R. P., Waikuku (Line B)	6	..	2
Rollinson, F., and Sons, Studholme Junction (Line A)	7	..	6
Rollinson, F., and Sons, Studholme Junction (Line B)	6	..	6
Saunders, E. E., Studholme Junction (Line A) ..	5	..	4
Saunders, E. E., Studholme Junction (Line B) ..	5	..	4
Saunders, F. L., Studholme Junction (Line A) ..	5	..	5
Saunders, F. L., Studholme Junction (Line B) ..	5	..	4
Sides, G., Studholme Junction (Line A)	6	..	3
Sides, G., Studholme Junction (Line B)	6	..	2
Topham, J. W., Arowhenua, Temuka (Line A) ..	7	..	1
Topham, J. W., Arowhenua, Temuka (Line B) ..	7	..	1
Topham, J. W., Arowhenua, Temuka (Line C) ..	5	..	1
Wilson, D. B., Grassy Hills R.M.D., Waimate ..	5	..	1
Wilson, E. R., Junction Road, Waimate.. ..	7	..	3
ARRAN BANNER.			
Mother Seed:—			
Amyes, H. C., R.M.D., Annat	4	..	1
Burgess, D., West Plains, Invercargill	3	..	1½
Carr, C., R.M.D., Tuatapere-Pukemaori	2	..	1½
Cooper, J., Croydon Road, Gore	3	..	1
Government Pure Seed Station, Box 4, Lincoln ..	3	..	1½
Hellyer, F. E., Macandrew Bay, Dunedin ..	4	..	1
Henderson Bros., Otapiri R.M.D., Winton ..	3	..	1
Knowler, C. E., Tuatapere	2	0·3	1
Milburn, M., R.M.D., Wright's Bush - Gladfield ..	2	..	1
McAdam, H. M., R.M.D., Invercargill-Glencoe ..	2	..	1
MacAlister, J. G., Otapiri R.M.D., Winton ..	3	..	1
Oakley, W., R.M.D., Halkett	3	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
ARRAN BANNER—*continued.*			
Mother Seed—continued.			
Robinson, R. P, Waikuku	4	..	1
Sheddan, G B, R.M.D, Invercargill-Otahuti ..	3	..	1
Wilson, C H., Lorneville, Invercargill	1	..	1
Wright, L. T., Annat	3	..	7
Commercial Seed :—			
Bell, J. F., Stirling	7	..	1
Dyer, H, Southbrook	7	..	1
Guy, T. A. and E. B., Yaldhurst	7	..	4
Hayman, Mrs. F., Willowbridge	6	..	6
Henderson, G, R M D., Courtenay	7	..	1
Manson, D. J, Enfield, via Oamaru	7	..	1
McCarthy, E., Prebbleton	5	..	2
McNae, F, R M D, Courtenay (Line A) ..	6	0·5	4
McNae, F., R M D, Courtenay (Line B) ..	6	..	6
Payne, J, R.M D, Courtenay	6	..	2
Penn, T A, 154 Innes Road, Christchurch ..	7	..	1
Porter, E, St Andrew's	6	..	3
Robson, F. H, Box 22, Lincoln	7	..	1½
Roper, P F, R.M.D, Halkett	7	..	1
Steele, J, R M D, Kimberley	7	..	1
Woodfield, L T., Albert Street, Invercargill ..	5	..	1
AUCKLANDER TALL TOP.			
Mother Seed :—			
Court, R T., R.M.D, Swannanoa (Line C) ..	5	..	9
Cross, H E, R.M D, Weedon's-Courtenay ..	4	..	3
Eder, W, R M.D., Sefton	4	..	1
Frost, C H, P.O, Balcairn	3	..	5
Government Pure Seed Station, Box 4, Lincoln ..	3	..	½
Guy, T. A and E. B, Yaldhurst	3	..	3
Steele, F, Fernside, Rangiora	5	..	3
Commercial Seed :—			
Beal, H. W, Eyreton R.M D, Kaiapoi	6	..	4
Crawford, A W, 140 Belfast Road, Belfast ..	7	..	4
Hawke, McK., Landsborough Road, Timaru ..	7	..	2
Hewson, R. H, Seadown, Timaru	7	..	1
Inch, E J., Woodend Road, Rangiora	8	..	3
Miller, G, Seadown, Timaru	8	..	2
Seyb, L, Washdyke, Timaru (Line A)	7	..	1
Seyb, L, Washdyke, Timaru (Line B)	6	..	1
KING EDWARD.			
Mother Seed :—			
Anderson, A, Stirling (Line A)	3	..	1
Brown, A. F., 287 Withell's Road, Riccarton, Christchurch	2	..	1
Burgess, D., West Plains, Invercargill (Line A) ..	2	..	1
Burgess, D., West Plains, Invercargill (Line B) ..	3	..	1
Cox, S., Box 9, Willowbridge	3	..	1
Griffin, J. G., Te Waewae, Southland	3	..	2
Knowler, H. C., Te Waewae, Southland	2	..	1
Kokay, S., Tuatapere	3	0·3	6
Mehrtens, J. C., Box 27, Tuatapere	2	..	1
Milburn, M., R.M.D., Wright's Bush - Gladfield ..	3	..	1
Commercial Seed :—			
Anderson, A., Stirling (Line B)	4	..	4
Brown, W. E., Orepuki	4	0·3	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
KING EDWARD—*continued.*			
Commercial Seed—continued.			
Craig, G. H., Factory Road, Mosgiel	5	..	1
Gilchrist, P P , 187 Tay Street, Invercargill	5	..	1
Wilkins, J H , Milton	4	..	1
JERSEY BENNES			
Mother Seed :—			
Burgess, D., West Plains, Invercargill	2	..	1½
Milburn, M , R.M D , Wright's Bush - Gladfield	2	..	1
Penn, T. A., 154 Innes Road, Christchurch	2	..	1
Wilson Bros., Quarantine Island, Port Chalmers	2	..	1
Commercial Seed :—			
Craig, G. H , Factory Road, Mosgiel	4	..	1
Graham, J W , Factory Road, Mosgiel	4	..	1
EARLY REGENT BOLTER.			
Mother Seed .—			
Oakley, W , R.M D., Halkett	3	..	8
Pascoe, S , R.M.D , Halkett	3	..	3
Robinson, R. G., Box 4, Papanui	2	..	1
Commercial Seed —			
Oakley, J. T., R M D , Eiffelton	5	..	4
EARLY ROSE.			
Mother Seed :—			
Burns, R. A. C , Te Pirita R M.D , Rakaia	5	..	3
Caldwell, G., R M D., Courtenay	3	..	1
Shellock, W., Te Pirita R M D., Rakaia	4	..	1
Commercial Seed :—			
Weaver, J., Te Pirita R M D., Rakaia	7	..	3
EPICURE.			
Mother Seed :—			
Robinson, R. G , Box 4, Papanui	3	..	1
Shellock, W., Te Pirita R.M D., Rakaia	4	..	4
Wright, L. T., Annat (Line B)	4	..	2
Commercial Seed :—			
Campbell, D , King Street, Rangiora	5	..	2
IRON DUKE.			
Commercial Seed :—			
Government Pure Seed Station, Box 4, Lincoln	6	..	1
Guy Bros., Springbank R M D , Rangiora	9	..	15
Herridge, F. G., Woodend	8	..	5
Penn, T. A , 154 Innes Road, Christchurch	6	..	1
BRESEE'S PROLIFIC.			
Commercial Seed :—			
Allen, A., R.M.D., Leeston	9	..	2
Marshall, D., R.M.D., Leeston	9	..	5
New Zealand Loan Co., Christchurch	9	0·2	3
GREAT SCOT.			
Mother Seed :—			
Wright, L. T., Annat	4	..	7
Wright, Q., Annat	3	..	2
Commercial Seed :—			
Government Pure Seed Station, Box 4, Lincoln	6	..	½

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
MAJESTIC.			
Mother Seed :—			
Cross, H. E., R.M D., Weedon's - Courtenay ..	3	..	1
Penn, T. A., 154 Innes Road, Christchurch ..	4	..	1
Commercial Seed :—			
Oakley, J. T., R.M D., Eiffelton	7	..	2
ROBIN ADAIR.			
Commercial Seed .—			
Jellie, J , Russley Road, Fendalton, Christchurch..	6	..	1
Marshall, D., R M D , Leeston	8	0·2	2
Wright, O , Annat	9	..	1
UP-TO-DATE.			
Commercial Seed :—			
Guy, T A and E B , Yaldhurst	7	..	2
Kokay, S , Tuatapere	6	..	5
Steele, J , R M D , Kimberley	6	..	2
ALLY			
Commercial Seed —			
Government Pure Seed Station, Box 4, Lincoln ..	8	..	¼
Stalker, W , Box 25, Rangiora	8	..	2
ARRAN CONSUL			
Mother Seed -			
Government Pure Seed Station, Box 4, Lincoln ..	5	..	½
Commercial Seed —			
Robinson, R G , Box 4, Papanui	8	..	1
KERR'S PINK.			
Commercial Seed :-			
Government Pure Seed Station, Box 4, Lincoln ..	6	..	¼
Hayman, A B , Willowbridge	6	..	1
EARLY REGENT			
Mother Seed —			
Government Pure Seed Station, Box 4, Lincoln ..	5	..	½

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 5th April to 17th May, 1934, include the following of agricultural interest :—

No. 69790 : Milking-machine installation ; R F Mehrtens No 69921 : Removing hair from animal-skins , S. V. Burridge. No. 69970 : Cream-cooling device ; J A. Parr. No. 70418 : Teat-cup , L. A Sheehan. No 71441 Milking-machine ; F. A. Stempa. No 71562 : Mowing-machine ; M. A Cheadle No. 71631 : Harrow-tine ; A S Bevin No. 71353 : Fungicide , E I du Pont de Nemours and Co No. 71605 : Removing wool from skins ; I W Archibald and T. S. Bull. No. 71746 : Milk-cooling ; A. M L Gjuteri and A. C O. Treschow. No. 70120 : Hay-stacker ; R. P. Short No. 71024 : Grass-cultivator : J. Macalister. No. 71875 : Cattle-bail ; J. Hope.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

PRODUCTION OF CLEAN MILK.

INFORMATION ISSUED TO REGISTERED DAIRYMEN.

The Live-stock Division.

CLEAN milk has been defined as "the normal secretion from the normal udder of a healthy cow, uncontaminated by extraneous influences."

There is universal agreement that milk as an article of food possesses a high nutritive value, more especially for use in infancy and childhood. In view of this fact milk producers and distributors should recognize readily the paramount importance of *clean* and safe milk, and be prepared to join in co-operative effort in the providing of a wholesome supply.

As the consumer becomes educated to demand cleaner milk so must the dairy-farmer prepare himself to meet that demand. By the production of cleaner milk not only will an important safeguard to the health of the community be provided, but the farmer will be in a position to offer a further guarantee regarding the keeping qualities of his product, with the possibility of advantage to himself by increased consumption, and a *better price for a better article*

SOME ESSENTIALS OF CLEAN MILK PRODUCTION.

1. *Mentality*.—There is no doubt that the most important factor in the efficient production and handling of *clean* milk is the mentality of the individual concerned, who must realize that milk is easily spoiled by contamination with bacterial organisms and dirt not necessarily visible to the naked eye, and who must be determined to carry out the best-known methods of producing and handling milk on all occasions, often at hours of the day and under conditions which do not make it an easy task.

2. *Water-supply*.—The next important factor on the dairy-farm is an abundant supply of *clean* water, without which general cleanliness, proper drainage, and thorough cooling of milk is impossible.

3. *Cooling of Milk*.—It is generally recognized that one of the best methods for controlling bacterial activity in milk is the regulation of the temperature. Cooling of milk as rapidly as possible after it is drawn from the cow *increases the keeping qualities*. In New Zealand a regulation under the Dairy Industry Act, 1908, requires milk to be cooled, immediately after milking, to a temperature of not more than 65° F.

Up to the present the most practical and economical method of cooling is by allowing the milk to run over a large metal surface, on the other side of which cold water is circulating. The most efficient apparatus for this purpose is the vertical corrugated cooler.

4. *Boiling Water and Steam Sterilization*.—Adequate facilities must exist for the provision of an ample supply of *boiling water*, for the purpose of scalding all utensils, &c. Efficient washing of all utensils is essential for the production and handling of *clean* milk. As soon as they are finished with the utensils should first be rinsed thoroughly with cold water to avoid a film of coagulated milk forming on their surfaces. They then require scrubbing with hot water and soda, which removes all trace of milk, &c., which may still be adhering to them, and finally they should be thoroughly scalded with *boiling water*. After this process the utensils should be placed on a *clean* rack to dry, buckets, &c., to be inverted.

The most efficient method of cleaning utensils is one which sterilizes them and leaves them dry, and for this purpose steam is by far the most effective agent to use, but it must not be thought that washing can be dispensed with if steam for sterilization is available.

The late Dr. Stenhouse Williams and his colleagues at Reading showed by numerous experiments that steam was more effective and reliable than any practical method of chemical sterilization. It leaves the utensils in perfect order for their next use, without the slightest risk of tainting the milk.

It is a common mistake, however, to suppose that if steam is applied to a utensil, sterilization has taken place. There are two main points to be remembered if successful sterilization by steam is to be accomplished: (1) The right temperature must be maintained throughout the period during which sterilization is taking place, and (2) the steam shall be employed in sufficient quantity for a sufficient

length of time. The aim should be to keep the temperature of the steam at about 210° F. and be able to submit the utensils to its action for a period of not less than five minutes.

One method in use in many small dairies takes advantage of the ordinary copper. A hole is bored in the lid and a short spout inserted. A good fire under the copper and the water properly and continuously *boiling* sends a good jet of steam through the spout, over which cans, buckets, &c., can be inverted for the required period of time.

5. *The Milker.*—Milk only with *clean* dry hands. "Wet" milking is a dirty habit and quite unnecessary. If the cow's teats are sore, or if for any other reason lubrication is considered desirable, a thin smear of vaseline is all that is needed. Do not handle the milk or cows if you are suffering from or recently had any infectious disease. Remember the spread of human diseases through the agency of milk is a factor of greater significance than the direct transmission of infection from cattle. Hands and nails should be *clean*. Wear a *clean* overall during milking.

6. *The Cow.*—Keep the tail trimmed and the hair clipped round the flanks and udder. Wash the udder and teats before milking with *clean* water, and *clean* utensils provided for the purpose. Do not feed hay during milking; it creates dust. Milk a case of mammitis *last* into a vessel which is not used for dairy purposes, and which contains some disinfectant. Do not use milk from a cow not properly cleansed after calving. Reject the fore milk. The first jets of milk from the teat are generally fairly rich in bacteria. Report any suspicious cases of disease scheduled under the Stock Act, 1908, viz.: Tuberculosis; actinomycosis (popularly termed "wooden tongue" or "lumpy jaw"), and any tumour formation.

7. *The Cow-shed.*—Keep cow-shed and dairy washed down after each milking, and yards and drains *clean* and free from accumulation of rubbish. Keep feeding-material as far away as possible from milking-shed and dairy. Keep the milking-stools and leg-ropes *clean*.

8. *Milk and Utensils.*—Keep dogs, cats, fowls, flies, &c., away from the milk. There is no doubt improvement would be effected by the use of covered buckets for milking, instead of the uncovered ones in vogue. Remove the milk from the cow-shed to the dairy immediately, and strain and cool. An efficient strainer is the "Ulax," but a fresh filter pad must be used for each milking.

9. *Milking-machines.*—The fact that the milking-machine, if not scrupulously *clean*, acts as a sort of microbial reservoir from which the milk is generously seeded as it passes through the pipes should be too well known to need stressing. The best method of cleaning milking-machines is described by Mr. J. W. Smith, of the Dairy Division, in the *New Zealand Journal of Agriculture*, from which the following extract is taken:—

"(1) Before milking draw cold water through all milk-tubes and the releaser, so as to prevent the adhesion of milk to the pipes, &c.

"(2) Immediately after milking wash all dirt off the outside of the teat-cups and rubbers; then draw through each set of teat-cups sufficient cold (or preferably warm) water to flush out the milk system. When drawing the water through the set farthest from the releaser insert a ball of horsehair in the end of the milk-pipe, to cause it to travel through the releaser with the water.

"(3) Next draw through each set of teat-cups *not less than 1 gallon of boiling water*, to which caustic soda has been added at the rate of 1 to 1½ teaspoonfuls per *4 gallons of boiling water*. Distribute the solution as evenly as possible through each set of teat-cups.

"(4) Immediately follow by flushing out the caustic-soda solution with 2 gallons of hot water or 1 gallon of boiling water for each set of teat-cups. The flushing with boiling water helps to dry the rubber and leaves the milk system dry and sweet.

"(5) Then remove or open the plug or flap from the releaser pipe to allow of free circulation of air.

"(6) Next clean the vacuum system in the same manner as the milk system, by drawing through first the caustic-soda solution, and next the boiling water which has been circulated through the milk system. Pay particular attention to the cleaning of the pipe connecting the releaser to the vacuum-tank, by flooding the releaser to cause the water to travel through to the vacuum-tank. This is important.

"(7) The engine can now be stopped. Disconnect the two long rubbers from downpipes and teat-cups, and hang in a clean, airy place out of the sun.

"(8) Next disconnect the releaser and wash, rinse, and place in a clean, dry, sunny place; then disconnect the top or bottom half of the vacuum-tank, and treat in a similar manner

"To ensure effective cleaning by this method it is essential that it be carried out daily in the manner directed. The caustic-soda solution instantly removes the greasy coating left by the milk on the inner surface of the tubing, and the final flushing with boiling water ensures the removal of the caustic-soda solution. In a short time the inner surface of the rubbers, through the action of the caustic soda, will become coated with a hard, glasslike surface If, however, the method is not carried out daily in the manner directed the grease will penetrate into the rubber, and it will then be necessary to revert to the use of spiral brushes, which in turn will damage the inner surface"

Finally, equally important is the safeguarding of milk from outside sources of contamination after it leaves the farm—during transit, in depots, in shops, and during distribution This work requires unremitting care

ARTIFICIAL FERTILIZERS CARRIED BY RAIL.

THE figures for artificial fertilizers carried by rail for the twelve months ended 31st March, 1934, are now available, and the Dominion total discloses a decrease of 61,217 tons as compared with the figures for the previous twelve months the figures being respectively 1933 34, 552,233 tons, 1932-33, 613,450 tons. It is of interest to note that the tonnage is the lowest recorded since 1926 27, also that the past season's Dominion total is not greatly in excess of the North Island total of 531,307 tons for 1928-29

Dominion figures, in tons, for the years 1926 27 to 1933 34 are as follows 1926–27, 446,751, 1927 28, 588,459, 1928-29, 708,515, 1929-30, 691,604, 1930-31, 568,491; 1931 32, 570,144, 1932–33, 613,450; and 1933–34, 552,233

The figures for the North and South Islands for the past three years are:—

	North Island Tons.	South Island. Tons.
1931 32	435,237	134,907
1932–33	463,603	149,847
1933–34	394,156*	158,077*

* Approximate figures only.

In connection with the apparent consistent increase shown by the South Island figures it must be remembered that the 1933–34 tonnage is appreciably lower than the figures for any of the years 1928-29 to 1930-31 The tonnage carried in the South Island during the year 1929-30 was 213,860.

The railway figures cannot, of course, be accepted as indicating the quantities of fertilizers used by farmers, as the figures cover large quantities railed to manufacturing-works, which quantities are subsequently included in the outwards figures for these stations Again, it is certain that fairly large quantities are railed to distributing centres and a portion at least rerailed to farmers The figures over a number of year will indicate the trend in respect of the use of fertilizers, although, obviously, the figures for any particular year may not indicate definitely the position in that particular year.

The recommendations of the Conference held last January between representatives of the Breed Societies, the Royal Agricultural Society of England, and the Ministry of Agriculture in regard to the future arrangements for continuing the London Quarantine Station for exported stock have now been approved by the Government. These recommendations include the transfer of the actual administration of the Station from the Royal Agricultural Society to the Ministry as from 1st April, 1934, and certain increases in the fees charged in respect of animals entering the Station.

SEASONAL NOTES.

THE FARM.

Top-dressing.

In many important grass-farming districts it has been found by experience to be advantageous to top-dress in July. Where, as often is the case, it is desired to obtain additional feed as soon as possible, then ordinarily superphosphate should be used. Regularly in these notes the application of superphosphate and of other phosphates to grassland much earlier in the season has been recommended, but farmers who have not carried out enough top-dressing in the autumn would be wiser generally to top-dress in July or thereabouts than to omit top-dressing for the season.

If there is a prospect of a feed shortage in August and September, then top-dressing about mid-July with sulphate of ammonia may be advisable. It is impossible to tender definite advice on this matter, for much depends on how acute the need is for additional early feed and how, alternatively, it could be supplied—*e.g.*, what would be the cost of purchased roots, hay, &c., to replace the additional early feed that is expected to result from top-dressing with sulphate of ammonia. Should top-dressing with sulphate of ammonia be decided upon, then, if possible, well-drained pastures containing a good deal of rye-grass should be selected for the purpose. Coarse, dry herbage should be removed from them by suitable close even grazing, and they should be harrowed prior to the application of sulphate of ammonia, with which as a general rule superphosphate should be applied if the pasture has not been top-dressed relatively recently with a phosphatic fertilizer. It is usually inadvisable to apply a nitrogenous fertilizer such as sulphate of ammonia earlier than the middle of July; it appears not to be able to stimulate growth of plants which are dormant essentially because of a low soil temperature, and if a quickly acting nitrogenous fertilizer is applied to such plants its potential effect seems not merely to be deferred but to be wasted.

While soluble nitrogenous manures, such as sulphate of ammonia, may be expected to be of some service as emergency means of increasing the supply of early feed, it becomes especially advisable during times of low prices of farm produce to endeavour to assess the value of the additional early feed on the basis of produce prices. In such assessing it should be remembered that the influence of additional early feed may be felt long after the additional feed has been consumed. For instance, additional early feed might enable three more dairy cows to be carried during the critical late winter—early spring period—a result which would be reflected in the farm returns for months afterwards. There is considerable field evidence pointing to the conclusion that the repeated dressing of a pasture with sulphate of ammonia season after season may lead to appreciable injury to the sward. Hence the same pasture should not be repeatedly dressed with sulphate of ammonia to produce early feed.

Harrowing and Spelling of Pastures.

Grass-harrowing widely calls for attention in July even though considerable harrowing has been carried out earlier. Harrowing of pastures which have been stocked heavily in May or June with cattle or horses is as a rule particularly desirable. Harrowing is also likely to be useful on fields on which there still is matted or coarse growth some of which at times is left as a legacy from unchecked, matured, autumn growth.

When possible, it is often advisable to close in July well-drained, well-sheltered paddocks for the use later on of calving or lambing stock. Rye-grass is of particular value in such paddocks because of its habit of early growth.

Winter poaching of wet, soft paddocks at times causes substantial permanent damage; it leads not only to the burial and loss of valuable pasture plants, but also to the establishment of weeds such as thistles, rushes, buttercups, and daisies on the bare surfaces created by the trampling in of useful plants. Young pastures particularly are likely to be damaged by poaching, which is most serious on heavy types of soil. Not a great deal can be done relative to poaching of pastures beyond avoiding as far as possible the stocking of those portions of the farm which are most subject to poaching damage. With this in view it may at times be advisable to concentrate the feeding of stock on a worn-out pasture which it is planned soon to put under cultivation.

The Problem of Inferior Pastures.

Especially in the principal grass-farming districts, there has been evidence of a tendency to persevere with worn-out pastures, when at times the more profitable course would have been to turn them over, and this especially is so of those many farms on which there usually is scant provision of special feed for use during the critical seasons of low supplies of feed directly from pastures. It is realized that worn-out pastures can often be improved appreciably by judicious top-dressing, &c., but as a rule repairing of pastures is a relatively slow process, and, further, the amount of improvement possible, which is determined largely by the plants which are present at the outset, is at times not as great as is desirable. If a farmer is lacking the necessary equipment and handicapped in respect to matters of finance and labour, then he may be justified in repairing a pasture which otherwise should be ploughed under, but apart from such instances the case for the renewal instead of the repairing of worn-out pastures is a strong one, a process of pasture renewal not only can be accomplished quickly but gives an opportunity of establishing more valuable species and of using better strains that may not have been readily obtainable when the pasture was previously sown. In this connection it is well to remember that while inferior pastures are not always so because of the fertility and other conditions under which they occur, this is often the case. The possibility of pastures being inferior to their natural conditions warrants brief consideration; there may, for instance, be a rapid falling-off in the rye-grass content of a young pasture when the conditions are suitable for rye-grass. Such a falling-off may be due to the ravages of the grass-grub, or, as is more probable, to the use of an inferior strain of rye-grass, which naturally is not persistent even under conditions of high fertility. If a pasture is inferior essentially because of the adverse conditions under which it is growing, then when this pasture is broken up primarily to be replaced by an improved sward it should be borne in mind that the mere sowing of seed fitted to give a good pasture will not necessarily give that pasture. If improved fertility through such practices as top-dressing and drainage is needed, then until it receives attention the sowing of good seed will be to some extent futile. At times this seems to be completely ignored. For instance, a sward inferior because of deficiency in plant-food is broken up and arable crops which impoverish the soil are grown before the land is again sown in grass. Actually it is not reasonable to expect a permanent improved pasture until the fertility is made better than it was prior to the impoverishment by the exhausting crops. In such circumstances any cropping prior to the sowing of permanent pastures should tend to increase instead of to deplete soil fertility. Though this may seem obvious, it is ignored in those numerous instances in which such crops as oats, maize, and millet precede permanent pasture, especially if the fertility of the land tends to be below the requirements of the type of pasture sought; these crops as a rule reduce fertility, particularly when they are not consumed where they are grown. It seems clear that if land has been worn out to some extent by cropping prior to sowing of permanent pasture, then generally a liberal fertilizing in the infancy of the new pasture becomes particularly desirable.

Drainage.

In general, winter proves the most suitable season in which to attend to farm drainage. One of the most important matters to be kept in mind is that money may easily be spent unwisely on drainage—even on land requiring drainage—unless the work is planned and carried out properly. As each drainage proposition is likely to contain aspects peculiar to itself, those desiring detailed guidance should apply to local officers of the Fields Division. The following general statements seem worthy of mention, mainly because they are at times ignored. The drainage of wet spots in a field is often the most profitable type of drainage a farmer can undertake. In the drainage of isolated wet spots an endeavour should be made—particularly if tile drains are being employed—to locate the drain-lines so that the drains may serve as part of more thorough and comprehensive future work and probably be the basis of it. As a rule, the first few pounds spent on drainage return the greatest profit relatively. The first thing that should be studied in planning a drainage system is the source of the excessive amount of water—the possibility of cheap drainage of an area by preventing water reaching it instead of costly drainage by removal of water may be revealed. This is especially applicable to wet areas along hillsides or on foothills. Mole drainage, under suitable conditions for it, is likely to be especially attractive when the benefit it confers is considered in relation to the annual charge involved.

Apart from new drainage work, there is often need in July to do maintenance work in respect to existing drains, which at least should be inspected periodically to ensure that they are functioning continuously. Too often the outlets are allowed to remain choked. All indications of failure of drains or of want of drainage should be noted, the former with the object of bringing about free flow and the latter with the object of knowing how to carry out most efficiently any future drainage work.

General Cropping Work.

Pits, and especially trenches, could be employed effectively in ensilage much more generally than seems to be realized. Ordinarily they are more economical in respect both to labour and to wastage of material than are stacks, but the stack system of ensilage has definite merits and should be adopted if circumstances are not favourable to pits or trenches. Two matters which need attention in the construction of pits and trenches are convenience of location and the avoidance in the excavated space of corners, which militate against the desirably thorough packing of the material to be ensiled. The fact that a great number of trenches are being employed successfully in level fields is of assistance in securing convenience of location. Detailed information about trenches and pits is contained in this Department's Bulletin No. 146.

As a rule, seed-sowing in the latter part of June and in July should be avoided, but as spring oats and wheat are usually sown in August and September and barley in September and early October, all possible progress should be made with the tillage work in preparation for these cereals. Care should be taken, however, not to carry out tillage when the ground is so wet that injury to tilth results. When the ground clings freely to boots or implements, then cultivation, though urgent, should be deferred. At times ploughing of old pastures can be carried out safely when ploughing of adjacent land which has been cultivated recently would be injurious because of its wet condition.

The best returns from pastures are not obtained as a rule unless crops to serve as auxiliary sources of feed are suitably grown. One of the greatest weaknesses in New Zealand farming is that insufficient quantities of such crops are usually grown. The crops other than grass which are to be grown during the coming season should be decided upon without any great further

delay to allow of preparatory cultivation being initiated in good time. Crops which in view of their outstanding value as auxiliaries to pastures have been strangely neglected are mangels and lucerne.

If preparatory cultivation for lucerne is not already in progress, generally it should be commenced at an early date The area of lucerne in New Zealand is growing steadily—the area cut for hay in the latest season for which figures are available (1932–33) was more than 8,000 acres greater than the corresponding area seven years earlier—and as New Zealand experience accumulates it confirms that of other countries by showing what a definite misconception it is to hold that lucerne is specially exacting in its requirements, and this misconception is largely the cause of lucerne not being as widely grown as its worth warrants. Detailed guidance regarding lucerne culture is contained in this Department's Bulletin No. 155 which is available for free distribution.

Crop Utilization.

Poor winter feeding of stock is a common and grevious weakness of New Zealand farming The dairy cow and particularly the developing dairy heifer frequently are fed so poorly that their subsequent production suffers substantially, and, though it is difficult at this stage to remedy satisfactorily a weak position during this winter, everything possible should be done to do so, and the requirements of future winters should be kept in mind in considering the approaching cropping season.

Cereals sown in the autumn should be fed off before growth becomes too long. Chou moellier is generally in good condition for feeding in July and should be used then, for sometimes in August it develops a tendency to run to flower-stalks. The feeding of roots should be carried out widely. After swedes, carrots and mangels should be fed in the order named. The feeding of roots and silage together in considerable quantities should, when possible, be avoided; they are both relatively bulky, watery feed which tend to balance well with hay of good quality.

The Use of Silage.

The value of silage as a winter feed for cattle and sheep has been fully established by the results obtained by individual farmers throughout the Dominion, but occasionally mistakes in the feeding of silage arise from attributing to a given quantity of it a greater feeding-value, relative to a similar quantity of hay or roots, than it really possesses. The general position may be deduced from the following facts: (1) 1 lb. of grass silage equals in feeding-value approximately 2 lb of roots; (2) 2½ lb. of grass silage equals in feeding-value 1 lb. of average good hay; (3) a typical satisfactory full-maintenance daily ration for a dry in-calf dairy cow is approximately 40 lb. mangels, together with 12 lb. of average hay.

Simple calculations disclose that 50 lb. of grass silage is the nutritive equivalent of this ration. Without any evidence of harm, quantities considerably in excess of this amount have been fed; but in practice it is seldom necessary for stock to subsist on silage alone, and so the question whether it is desirable for them to do so is not of much moment in practice. On many farms silage has served with success as the sole supplement to pastures during the winter and early-spring period of scant grass-growth. Whether greater success would have resulted from the use of other supplements such as hay in conjunction with the silage is a moot point.

The feeding-out of diseased swedes on land which will be sown in turnips, swedes, or rape after a season or so should be avoided, as it may readily lead to the land being contaminated with club-root.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Pruning Operations.

ADVANTAGE should be taken of every fine day to hurry on with the seasonal work. The late-autumn operations outlined in previous notes such as ploughing, draining, &c., should have been completed. The period of the year that is devoted to pruning is from June to about the end of July. This period is the dormant or resting season for deciduous trees, in so far as the leaves will have fallen, the sap become quiescent, and the whole tree-structure at rest. Many growers speak of the sap as being down during the dormant season and coming up or rising in the spring-time. Apparently they believe that the sap flows to the roots in the autumn and returns to the branches, &c., in the spring. This is quite erroneous, however: the sap is simply more or less stationary during the colder period and with the return of spring becomes active again. Pruning is an orchard practice which should be undertaken only by experienced persons, while beginners wishing to become qualified pruners should be under supervision. The main object of pruning changes with the development of the tree. For the first four or five years after planting the aim is to establish a strong, healthy rooting system as well as to develop the framework of the tree. For the next few years, whilst the tree continues to develop, an endeavour should be made to induce fruit-production. Once this desired result has been accomplished, the maintenance of growth and prevention of over-cropping become of primary importance; at the same time it is necessary to ensure sufficient vigour for the maintenance of a healthy tree capable of producing an annual crop of first-grade fruit throughout a long life. When pruning, the operator must at all times bear in mind the importance of building or growing a tree with sturdy leaders and subleaders. These should be spaced evenly all round at a distance of at least 2 ft. apart. These leaders and subleaders forming the frame of the tree should be arranged so as to form an oblique angle from the trunk or stem. In this way the desired tree with an open centre is developed. An open centre not only exposes the inside of the tree to the sunlight which is so essential for the development and ripening of buds, wood, and fruit, but facilitates spraying and other cultural operations.

Once the frame of the tree has been developed (say, from six to nine years after planting), the following rules (which appear to operate almost invariably in the growth of plants), if observed, will be of great assistance to the operator when pruning:—

1 The vigour of a plant or of a shoot is dependent on the leaf surface upon it.

2. The nearer a shoot approaches a vertical position the stronger is the growth.

3. The nearer a shoot approaches a horizontal position the more its vigour diminishes.

4. The topmost shoots absorb most sap and outgrow those below

5. Retarding the sap-flow operates against heavy growth, as a result of it fruit-buds develop. (This is achieved by very light or no pruning.)

6. Severe pruning increases the sap-flow, which in turn induces heavy wood-growth unfavourable for fruit-bud development. Each tree has its own individuality and should be pruned accordingly—*e.g.*, vigorously growing trees should be pruned comparatively lightly so as to steady the growth and leave ample wood for the development of fruit-spurs and lateral growths, and weakly growing trees should be pruned more severely with a view to promoting growth.

The leaders should be defined by cutting out strong competing growths that usually occur near the top of the tree. The leader itself should be shortened back (according to its vigour) to a bud pointing

in the direction in which growth is required, usually an outside bud. The foregoing remarks refer chiefly to apple and pear trees, but the general design of the tree as outlined is recommended for quince, apricot, peach, nectarine, and plum. The subsequent treatment of leaders of stone-fruits differs from that of pome fruits in so far as the leaders of stone-fruits should not be as clearly defined, and shortened back to the same extent as those on pome fruits.

The laterals are the greatest asset the tree possesses when viewed from a fruit-production point of view. Those of the current year's growth, if left intact, or lightly pruned, will form one or more fruit-buds, after which they may be shortened back to fruit-buds if desired. Very often the terminal bud of the current year's lateral will develop fruit during the following summer—for example, Irish Peach and Rome Beauty varieties. On the other hand, when the current year's lateral is shortened back, if the tree is at all vigorous, several new growths are formed and usually no fruit buds. The pruner should remove completely strong lateral growths, especially those in a vertical position, by cutting closely in to the main leaders or branches, leaving the weaker lateral growths for fruit-production. It may be necessary to remove some of the latter if crossing or over-crowding occurs. The centre of the trees should be kept open and not allowed to become overcrowded with unnecessary wood-growths.

The subsequent management of the fruit-spurs of stone-fruits differs in several points from that of pome fruits. In the latter, fruit-spurs require two or three years for their development, but when formed and matured they last with proper attention for a long period. In stone-fruit the fruit-spurs are of much quicker formation. The peach and nectarine bear fruit on one-year-old wood only. Japanese plums bear fruit on one-year-old wood and older, while the European plums produce fruit on two-year-old wood and older.

It is essential that the tools used for pruning be kept in good order, sharp and smooth, as a jagged or blunt blade often causes much damage by bruising the wood, which retards healing. All prunings should be gathered and destroyed by burning as soon as possible: the ashes can be returned to the orchard soil with beneficial results.

Grafting and Budding.

The scions for grafting should be selected at pruning-time from trees of known bearing habits, the wood should be well ripened, free from pests and diseases and should be of the past year's growth. As the scions will not be required for some time, they may be kept in good condition by burying the ends about 4 in. in the ground in a shady position. It is advisable to delay heading back the stocks until just prior to inserting the scion, otherwise a fresh cut is necessary. Stone-fruits to be budded should now be cut back so as to induce suitable growth for budding into.

Wounds and Wound Treatment.

Pruning of any kind causes a wound. The small sappy growths, however, quickly callus over without special attention provided the instrument used for pruning is sharp, clean, and smooth. On the other hand, when it is necessary to employ a saw (even a sharp saw) for the removal of larger branches the resultant wound will be jagged, and, if left untreated, not only will the cambium layer be prevented from functioning (by forming callus, thus healing over the wound) but an opening will be left for pests and diseases to make their entrance. In addition this introduces the risk of decay setting in. To treat such wounds, it is advisable to carefully trim the jagged edges of the bark with a sharp knife, leaving a finish with a bevelled edge, and to paint over with coal tar.

—*J. W. Whelan, Orchard Instructor, Palmerston North.*

Citrus Notes.

The next few months will be rather an anxious time for citrus growers in localities where frosts are likely to occur. There are few places in the Auckland Province where frosts are unknown during the winter months. However, in certain favoured situations, little, if any, damage is done to citrus trees. There are, however, some orchards in which a good deal of damage is likely to take place, not only to the trees, but to the fruit itself, unless preventive measures are adopted. Growers whose orchards are subject to injury due to frost should consider the advisability of protecting their trees by one of the methods which have been described in these notes from time to time. A certain amount of time, labour, and expense is involved, but the grower is usually amply repaid for all this, and, moreover, has the satisfaction of knowing that in addition to saving his present crop, he has also preserved his trees from injury which might be the means of reducing his crop the following year. Frost damage is most assuredly reflected in partial loss of the following season's yield. Every grower seeks the maximum yield of fruit from his trees, therefore nothing should be left undone that will prevent loss in future crops.

While the fruit of the orange-tree is often damaged by frost, the wood itself is not so liable to injury as that of the lemon. The wood-growth of the orange ceases much earlier in the season, and therefore has a chance to harden before the winter frosts occur.

Growers are urged again not to market oranges or lemons that have been affected by frost, as such a practice would depreciate the value of consignments, and would destroy the confidence of the consumer in New-Zealand-grown citrus fruit, confidence which has been established only after many years of perseverance, labour, and expense. If confidence were lost, it might be even more difficult to restore it than it has been to establish it in the local-grown fruit

Where new plantings are contemplated, every care should be taken to see that suitable conditions are provided for citrus trees in respect to shelter, preparation of the soil, and the selection of healthy, well-grown trees. Unless these obtain it is far better to defer planting until such time as conditions are favourable. Where young trees are planted out in exposed positions, and, moreover, in poorly prepared soil, they often receive a set-back from which they seldom satisfactorily recover.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Seasonable Reminders.

AUGUST and September are the principal months for hatching-out chickens, so that no time should now be lost in mating the breeding-pens It is always advisable to have the birds mated well ahead so that they may be suitably settled down before eggs are required for hatching purposes. There are no chicks that do so well as those brought out just after the days commence to lengthen, and are well settled down before the hot trying summer conditions prevail. Breeders would be well advised to study the notes which appeared in recent issues of the *Journal* on selecting the breeding-hens according to form. In these notes breeders were advised to select the required hens—the late moulters—for this season's breeding-pens before the moulting process sets in, for it is only then that the best specimens for breeding can be determined. Where the timely advice was acted upon and the late moulters and the best breeding-types were selected and marked accordingly, say, late in March, the work of mating will now be a simple matter. It is possible that, owing to their having developed some weakness, odd birds may have to be discarded in the final selection, but, generally speaking, where the work has been carried out by an experienced person, the remaining birds will be the select of the flock from almost any standpoint.

On plants where these important matters have been neglected till now it is difficult to estimate what loss may result eventually. For example, with the great majority of the hens now moulting, it is almost an impossible task to separate the desirable breeding specimens from those that are lacking in breeding-power. This being so, probably weak specimens will be used in the breeding-pen and these are almost sure to produce unprofitable progeny. While late moulting can generally be accepted as indicating good productive power, it is not to be inferred that all late moulters are suitable specimens for the breeding-pens. If a uniform flock is to be built up and maintained, something more is required, and if this result is to be achieved the breeder must have an ideal type in his eye, and keep this always in view remembering all the time that constitutional vigour forms the basis of all successful breeding operations. The usual signposts to these essential requirements are a " clean " face, clear bright prominent eyes, short shanks set wide apart, well-developed crop, tight thick feathering, and generally an active alert appearance.

In a general way, the qualifications to be looked for in a good breeding male, as indicating constitutional vigour and breeding-power, are generally similar to those required in the breeding-hen, excepting, of course, the natural sex differences. While feminine characteristics should be looked for in the female, the male should be practically at the other extreme. The head should be masculine in every respect, but without coarseness.

The Need to prepare now for Autumn and Winter Eggs.

The egg-market is now declining and many poultry-keepers are asking themselves why their hens commence laying only in the falling market. Such men have merely failed to strike the keynote of success—*i.e.*, hatching and rearing the chicks required at the right time and rearing them in such a manner that they will commence to lay at the commencement of the dear season rather than at the end of it. If everybody could breed to have birds laying during the late autumn and winter, eggs would be cheap instead of dear at these seasons. The fact that during recent months fresh eggs have commanded more than double the price of those produced during the season of greatest supply indicates how many producers there are out of the 154,000 poultry-keepers in the Dominion who fail to secure eggs when high prices rule. Obviously there can be no comparison made as regards profit between a bird laying the bulk of her eggs during the dear season and one producing her main yield in the cheap season, when almost any sort of fowl will lay. The poultry-keeper who succeeds in obtaining a high winter egg yield leaves nothing to chance. He realizes that winter eggs are an artificial production, and that artificial methods must be used to secure them. The production of eggs in the spring and summer months, when not only domesticated hens but the birds of the air breed and lay naturally, is a simple matter, but when a bird is expected to lay in winter it is entirely different. Everything must be done in a proper manner and at the right time. Those poultry-keepers who have failed to secure high-priced eggs in the past and who desire to obtain them during the next dear season must prepare for them now. Pullets must be depended upon, they must be hatched out at the right time, and, further, they must be well fed and managed throughout. The breeding-birds should be mated at once if this has not already been done, in order that fertile eggs may be available for hatching purposes during August and September. If the first chickens are hatched early in August they will commence to lay when the majority of the adult stock are terminating their laying-season, and at a time when egg prices commence to rise, although it is true that some of the first hatched pullets will moult in the early autumn and there will be a loss of winter eggs. But on well-managed plants there should be later hatched birds specially bred for laying during the cold months of the year. In any case, it would be an exceptionally small flock where all the early hatched birds moulted and ceased to lay at exactly the same time. Obviously some birds will moult earlier than others, so that when the latter are moulting

the former will have renewed their feathers and be ready to resume laying.

While it is not advisable to breed from pullets it hens can be obtained, the fact remains that on most plants there will be insufficient adult birds in the necessary productive condition to enable a desired number of chicks to be hatched during the early season, so that breeding from pullets must be resorted to. Where it is necessary to use pullets, they should be well matured birds that have been hatched in the early spring, and be the progeny of hens, not pullets. Care must be taken that they are mated not with a cockerel but with an adult male. It is far better to delay hatching operations than to breed from poorly-developed pullets or from ones from late hatches.

In the case of those who have to depend on the natural mother for hatching purposes, the difficulty of securing early chicks is realized, as at this period of the year broody hens are scarce, and, as a result, hatching operations are delayed beyond the most desirable season. Rather than delay on this account, however, the better plan is to resort to artificial methods by purchasing an incubator or by securing day-old chicks, or by obtaining pullets when about ten weeks old. The latter method as a means of overcoming the difficulty of securing broody hens when most required is an ideal one for the man in a small way, providing, of course, the young birds are purchased from a reliable breeder of stock of heavy production.

Management of Breeding Stock.

The management of the breeding-pens is a matter which demands much greater care than is usually given to it. It is a mistake to put too many hens with a rooster, just as it is to put too few. In closely confined quarters, not more than eight hens of the heavier breeds should be put with a male bird, and ten hens of the lighter breeds. On free range, which is most desirable for breeding-stock, the number of hens may be doubled. The diet is a most important item in breeding operations. The birds should be well fed on a plain diet, but on no account should high records in egg-yield be aimed at by feeding a heavy meat-ration, &c., or trouble will probably be met with in the hatching and rearing of the chicks. This is not to say that breeding-birds should be kept on a light ration, but rather that meat and similar forcing foods should be fed sparingly. The best plan is to supply at all times a mixture of any grains, such as wheat, maize, oats, &c. In fact, the greater the variety of grains fed the stronger will be the hatching qualities of the eggs and the easier will the chicks be to rear. If the birds are inclined to become too fat they should be encouraged to exercise by feeding the grain in deep litter. This is important, for a high percentage of fertile eggs containing strong germs cannot be expected from a hen that is over-fat.

It will be found usually that the most fertile eggs and the strongest chicks are produced from parents that have a free range, or are provided with large-sized runs. No doubt this is chiefly due to the variety of food picked up and the natural exercise which is taken by the birds in finding it, and which prevents them from putting on surplus fat. A necessary means of maintaining breeding-birds in good condition is to keep them well supplied with succulent green material.

The quarters should be kept in a sanitary state, and absolutely free from vermin. Especially does this apply to vermin such as red-mite, for a hen cannot produce good strong chicks if its life blood is being drawn away nightly by insect pests.

Too much care cannot be given to the breeding-birds. Much of the ill success met with in incubation, brooding, and rearing may be traced to mistakes made in the management of the breeding-pen. For instance, the male bird may be run down, and out of condition, or perhaps the hens are too fat and have insufficient exercise. It is a good plan to handle the male bird at night frequently, for he may be too attentive to the hens and

not be taking sufficient food, in which case it is impossible to get good results. If a male gets out of condition he should be replaced by another, and if this is not possible he should be fed at least once a day by himself.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Winter Inspection.

THE management of the apiary at this season consists chiefly in making an occasional round among the bees to see whether everything is in good order. On no account should the bees be unnecessarily meddled with. Where any doubt exists as to the stores required for wintering it may be necessary to open the hives. However, it is by far the better practice to try to estimate the quantity of stores on hand by lifting the back of the hives. Experienced beekeepers can in this way gauge by weight the stores present. Inexperienced beekeepers, will, of course, have to examine the combs. If it is necessary to do so, it is advisable to choose a fine day, and in any manipulation that follows on no account to break up the cluster of bees. After examination, it is well to close up the colony as soon as possible in order to conserve the heat. If a colony is found deficient of stores, a comb or two of honey or a cake of candy laid on top of the frames over the cluster will help considerably. At this season of the year bees will not take syrup readily. If combs of honey are on hand and feeding is carried out the combs should be placed on the outside of the cluster. To place them in the centre of the cluster will be the means of dividing it, and this will result in much harm to the bees and probably bring about their death.

Mats and Covers.

After heavy rains it is well to examine the mats over the frames. If any damp ones are found, they should be replaced with dry ones. A supply of mats should always be on hand. It will be necessary only to gently lift one end of the cover to discover the condition of the mat, and this can be done without disturbing the bees.

All covers that are not absolutely rainproof should receive attention. No better covering for roofs can be had than sheet lead. Such covers are costly to commence with, but are rainproof and do not require to be secured in windy locations. If sheet lead is found too expensive, the roofs may be covered with zinc or ruberoid If the latter material is used it should be heated before being fixed to the roofs.

Removing Spare Top Boxes.

All the top boxes that have not yet been removed should now be taken off and the bees confined to the brood-chambers. Breeding will commence shortly in colonies of normal strength in the warmer parts of the Dominion, and the hives should be made snug with well-fitting mats to conserve the heat of the hives. If it is found that the bees occupy only a top box, remove the lower one, and put the former in its place.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Seeds.

VEGETABLE seeds rarely fail to grow, but it is not uncommon to find one has sown them too thickly, not an inconsiderable waste so far as the more expensive kinds are concerned. In addition there is the further cost of thinning out the seedlings—a tedious job demanding great care. Other kinds of seeds may be sown, at what might be considered about the same rate, and the result is a thin crop. By studying the vitality and life of

seeds under normal conditions, the mistakes above mentioned, and some others, will be avoided, and better crops will be obtained at less expense. The following table has been compiled with a view to supplying some of the more important facts which will assist one to obtain good results :—

Vegetable Seed.	Average Germination.	Life of Stored Seed in Years.	Seeds required for 100 ft. Drill.
	Per Cent.		
Asparagus ..	85	5	1 oz
Beans (dwarf)	94	3	1 pint.
Beet	90	6	2 oz
Cabbage	90	5	¼ oz
Carrot	80	4	1 oz
Cauliflower	80	5	¼ oz
Celery	82	8	¼ oz
Corn sweet	94	2	¼ pint
Leek	88	2	½ oz
Lettuce	94	5	½ oz.
Onion	88	2	1 oz.
Parsley	75	3	¼ oz.
Parsnip .. .	80	2	½ oz
Peas	94	3	1 pint
Radish ..	94	5	1 oz
Spinach	85	5	1 oz
Tomato .. .	90	4	¼ oz
Turnip .. .	94	5	½ oz

The percentage of germination of a parcel of seeds will depend on its age and the conditions under which it was grown, harvested, and stored. In addition the natural vitality of the different kinds of seeds varies. The table shows such kinds as dwarf beans, lettuce, peas, radish, turnips, &c., to have high standard of germination generally, while carrot, cauliflower, parsley, parsnip, &c., have a comparatively low average germination percentage. If sowing is therefore adjusted accordingly, one can secure some of the benefits referred to above

Economy may be obtained also by studying the column under the heading of the life of stored vegetable-seeds The table gives a moderate estimate of the life of the seeds of long-lived kinds, but the figures regarding short-lived seeds, such as onion, parsley, and parsnip, should be taken as the limit for those kinds under ordinary conditions, and for best results new one-year seed should be used.

The time taken for vegetable-seeds to germinate varies widely : lettuce, radish, and turnip seeds are usually up in a week, while carrot, celery, and parsnips generally take from two to three weeks before making an appearance ; other kinds take about seven to fourteen days. For this reason, on land inclined to be weedy, it is sometimes convenient to sow a small quantity of radish-seed with the parsnip-seed so that the drills are indicated quickly, and hoeing, for the suppression of weeds, can be done without risk of injuring the crop.

Another important fact regarding vegetable-seeds is the type and strain of the plant they produce. Under natural conditions the original plant-type was comparatively consistent from year to year. The greatly improved types of the different kinds of vegetables that have been produced are maintained only by the most careful selection of seed-plants each year. The constant tendency is for such annual crops to revert to the wild type ; this is prevented only by removing before seeding commences plants showing such a tendency. It is the annual work of " rogueing," demanding so much time, patience, and skill, that makes seeds of high strain expensive.

This should always be remembered when purchasing seeds. By omitting the expensive operation of "rogueing" a much larger crop of seed would often be obtained with probably a high percentage of germination, but the quality would fall.

Considering the long life of most seeds and their value, they should be stored with great care; vermin, moisture, and heating are perhaps the greatest dangers. Mice, weevils, and other pests come under the first heading: these can be avoided by storing in clean, substantial structures free from infection. Seeds poorly harvested and cured are most likely to generate heat when stacked closely, particularly in poorly ventilated conditions. For this reason metal or glass containers are often unsatisfactory. Such vessels are an excellent safeguard against vermin only. Conditions generally most suitable for seeds of the class just mentioned are dry and well-ventilated, with a moderately warm even temperature. For convenience the seeds may be kept in secure stout-paper packets with name and date on the outside, or in linen bags with the identification label attached, in addition to another in the bag amongst the seed in case of accidents. These parcels may be stored in pigeonholes or in the drawers of a wooden cabinet. Obviously good seed in sound condition is a prime factor in satisfactory cropping.

Vegetable Crops.

Potatoes stored in the dark at ordinary temperatures, especially where ventilation is poor, will at this season send out long white sprouts that will badly depreciate the seed. For this reason seed potatoes should now be stacked in an open manner in an airy shed that is light and cool. They should be turned occasionally if they are in sacks and there is any sign of dampness. Sprouting the seed of early kinds in trays is quite a good practice. Under the conditions recommended short sturdy shoots are developed and these enable the seed potatoes to become established quickly when weather conditions permit them to be planted out. On light soils in warm localities this may occur towards the end of the month of July. Planting and sowing any crop, at this season, should be done only when the soil is dry and friable. One should be ready to take the opportunity as it arises, but it is a fatal mistake to plant or sow, at this season especially, land that is in the slightest degree what one might call wet.

Autumn-sown onions may be planted out, under proper conditions, in land that is rich, light, and well consolidated: it is advisable to trim off the tops and straggling roots of the young plants and to dibble them in about 6 in. apart in the rows. Garlic, shallots, and chives are vegetables of the same class which may be planted now. Chives is a perennial herb of mild onion flavour, and from it supplies may be obtained at any season. It requires but little attention and is very suitable for planting in the vicinity of week-end cottages or out-of-the-way places. Shallots are mild, excellent for sauces or pickles, and easily grown. Such crops planted now have a particular value in the warmer and more humid districts, as they ripen at mid-summer, when harvesting and proper curing may be done most satisfactorily and with least risk from disease.

Towards the end of the month of July, weather permitting, cabbage and cauliflower plants may be set out—also new plantings of rhubarb. Early peas, broad beans, artichokes, lettuce, spinach, and radish may be sown.

Small-fruit Crops.

When the soil is in condition plant out new brakes of bush fruits for which adequate preparation has been made. The exposure of the roots to wind and sun should be avoided, and the plants should be set firmly at the right depth after trimming away straggling roots and tops. When planting is completed, it is well to go through the crop and to prune

carefully each plant. Some inter-cropping with vegetables may be done in the first season ; but the welfare of the permanent crop should be given first consideration.

The Tomato Crop under Glass.

In preparation for setting out the plants towards the end of July or August, it is advisable to broadcast and to fork in such fertilizers as may be necessary a few weeks before planting. With a sufficient supply of humus present in the soil, the dressing usually consists of phosphates and potash, and where the drainage is doubtful or the soil is naturally heavy, finely-ground carbonate of lime may also be included : 3 oz. finely-ground bondust and 2 oz. each of superphosphate and sulphate of potash per square yard form a good fair dressing at this stage under ordinary conditions. Although the house may now be empty, it is an advantage to maintain a warm fresh atmosphere in preparation for planting ; allowing the air to become over-heated will dry out the soil to an extent which is undesirable.

A week or so before planting out it is advisable to place the plants in the house to harden off and to accommodate themselves to the new conditions. They should be planted firmly, rather deeply, and in a shallow trench. There is a tendency to crowd the plants together, which is very unwise, as it is the cause of much disease, especially in humid localities. The plant demands a dry, buoyant atmosphere to keep it in condition, and that can be secured in summer only by now setting the plants sufficiently far part—not less than 24 in. between rows and 12 in. between plants, with rather more space between the rows in districts where leaf-mould is very troublesome.

The Homestead Garden.

The busiest season in the garden now commences first where the soil is light and warm—on heavy soils rather later. Old lawns may now be reconditioned or new ones laid. Plants in the herbaceous border may be lifted and set out, carefully labelled, in nursery rows in the kitchen garden while the border is being trenched, manured, and put in good order with an even surface at the right level for replanting. Meanwhile it is advisable to take the list of plants and to scale-plan the suggested new arrangement on graph paper ; then, when the soil is in good condition, to place a numbered label in the ground each yard along the border front and back , then a garden-line or two from end to end dividing the border into yard-wide strips. The group outlines, as planned, may now be drawn on the ground and the drills filled with dry sand. Each space should be marked with a clearly-written label, and planting may be done, true to plan, as occasion permits. Let the herbaceous border be true to name , it might be made on the verge of shrubbery, but an evergreen hedge as back-ground is better. The only herbaceous plants in the shrubbery should be woodland plants quite at home under the conditions ; few of our highly improved hydrids are of this nature ; they require generous treatment that cannot be given in a shrubbery border.

In warm localities roses may be pruned, elsewhere such pruning is best left until the month of September, or young growth is apt to be destroyed by frost.

The removal and planting of trees and shrubs may be done when the land is in condition . generally it is best done now as soon as conditions permit. The fine autumn-tinted foliage, and berry plants, seen on every hand, offer good suggestions for the planting-list ; as do the fragrant daphne, ***Chimonanthus fragrans***, and ***Lonicera Standishii***, the " japonicas " (*Cydonia japonica*), camellias and wattle which, with others just as good, make the winter garden in these fortunate islands challenge the display of summer-time.

W. C. Hyde, Horticulturist, Wellington.

WEATHER RECORDS: MAY, 1934.

Dominion Meteorological Office.

NOTES FOR MAY.

THOUGH there were two rather severe storms during May, the weather for the greater part of the month was relatively quiet. Temperatures were, in the mean, considerably below normal, but there was only one really severe cold snap, that accompanying a southerly gale on the 17th to 18th.

Rainfall.—In much the greater part of the North Island the total rainfall was considerably below average, but small excesses were recorded in some areas around Auckland, in Southern Taranaki, and in Southern Wellington. In the South Island, the Nelson Province and Stewart Island had rather less than the average, but in the remainder it was a very wet month.

Temperatures were below average everywhere except in parts of Otago and Southland. The departures were rather large in the North Island. Frosts were rather numerous.

Pressure and Weather Systems.—The first event of meteorological importance in the month was the development of a remarkable cyclonic storm which reached its maximum intensity on the night of the 3rd. On the 2nd there was a trough of low pressure located west of New Zealand. It was not very deep, but it extended in almost a due north-and-south direction from north of Norfolk Island southward to beyond the region covered by our reports. It marked the boundary between warm air coming from the tropics and a colder mass lying to the west of it, which had a far southern origin. On the 2nd there was a small centre of low pressure in the above-mentioned trough situated in the neighbourhood of Norfolk Island, the lowest pressure being about 29·8 in. On the morning of the 3rd the storm centre had developed into a deep and full-fledged cyclone, the lowest pressure being near Cape Maria van Diemen and amounting to about 29·2 in. The southward movement was continued, and on the morning of the 4th the centre, where the pressure was now about 29·1 in., was near Wanganui. At this stage the storm was intensified through interaction with an older centre farther south. West of a line running from Russell through Wanganui, Wellington, and Christchurch, on down the east coast, was cold air moving from the south or southwest, while to the eastward was warm air moving at the speed of a gale from a northeasterly direction. Thus, at Akaroa a northeasterly gale was blowing, while at Christchurch there was a light southerly. This meant that the warm, moist air from the northeast was climbing rapidly up over the cold southerly, a condition ideal for the formation of heavy rain. And since the division-line between the two winds moved extremely slowly, the rain continued for a long time. This was the explanation of the extremely heavy rain which occurred on Banks Peninsula and the floods of record height which did so much damage at Little River and the surrounding district.

Another notable spell of stormy weather commenced on the 14th. From the 15th to the 17th most of the country, but especially the South Island, was afflicted with northwesterly or westerly gales. The spell concluded on the 17th to 18th with a southerly gale and a severe cold snap. Snow fell on the ranges in all parts of the country, and in Southland even the low levels were coated for a few hours. The high southerly winds caused further damage to trees, fences, &c. On the evening of the 17th a tornado, which was unusually severe for New Zealand, struck New Plymouth, partially wrecking a number of houses.

RAINFALL FOR MAY, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.	Total for Year to Date.	Average for Year to Date.
			North Island			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	5·36	12	1·69	6·61	15·95	21·57
Russell	6·86	13	3·58	7·07	19·54	20·84
Whangarei	6·03	17	2·17	7 88	18·07	25·06
Auckland	5·60	18	2·50	4·64	20·33	17·04
Hamilton	5·93	12	1·68	4·70	15·49	18·79
Rotorua	4·07	12	2·23	5·71	17·91	21·62
Kawhia	5·45	15	1·07	5·34	12·21	19·82
New Plymouth ..	3·69	16	0·95	6·18	19·37	22·48
Riversdale, Inglewood ..	5·82	17	1·21	9·69	29·53	38·38
Whangamomona ..	8·93	13	2·75	6·84	28·81	27·81
Hawera	4·74	13	1·03	4·58	17·23	16·98
Tairua	3·64	9	2·10	7·08	19·44	26·59
Tauranga	4·05	12	2·30	5·12	21·38	21·46
Maraehako Stn., Opotiki	3·07	8	1·73	5·70	15·99	22·13
Gisborne .. .	2·38	15	1·22	5·36	11·16	20·01
Taupo	3·71	12	2·24	3 95	17·21	16·80
Napier	1·30	11	0·33	3·64	13·44	15·26
Hastings	1·71	13	0·55	3·29	11·60	13·56
Whakarara Station ..	4·08	12	2·05	..	22·04	..
Taihape	2·89	18	0·64	3·46	13·71	14·25
Masterton	4·31	15	0·60	4·01	14·07	15·20
Patea	4·78	14	1·00	4·15	17·77	17·16
Wanganui	2·44	12	0·55	3·34	16·66	14·33
Foxton	2·21	10	0·70	3·19	12·82	11·88
Wellington	4·53	12	2·39	3·98	16·01	16·10
			South Island.			
Westport	5·85	19	1·08	8·35	40·38	37·65
Greymouth	7·25	18	1·35	8·10	37·04	40·76
Hokitika	6·49	16	2·00	9·61	39·02	45·84
Ross	12·36	15	3·39	9·83	55·10	54·04
Arthur's Pass.. ..	14·90	10	4·91	12·78	66·03	65·41
Okuru, South Westland	..	..	..	10·80	..	61·32
Collingwood	4·53	13	0·92	8·87	25·46	34·80
Nelson .. .	1·95	9	0·56	3·31	11·12	14·77
Spring Creek, Blenheim	3·19	10	1·45	3·03	8·39	11·53
Hanmer Springs ..	7·89	14	3·27	4·50	28·53	18·12
Highfield, Waiau ..	4·80	10	1·91	3·25	19·49	14·27
Gore Bay	4·90	19	2·25	3·41	20·89	13·18
Christchurch	7·34	15	2·19	2·51	15·22	10·27
Timaru	2·48	7	1·14	1·46	14·63	9·36
Lambrook Station, Fairlie	4·29	8	2·68	1·57	15·39	10·12
Benmore Stn., Clearburn	3·01	10	0·75	1·79	11·86	10·99
Oamaru	2·91	8	0·97	1·60	11·29	9·00
Queenstown	4·54	15	1·45	2·54	14·87	12·99
Clyde	..	..	..	0·99	..	6·84
Dunedin	7·19	18	2·35	3·10	19·68	14·97
Wendon	3·45	13	0·54	1·98	14·68	12·89
Gore	..	..	..	2·56	..	14·66
Invercargill	5·70	22	0·83	4·31	19·49	19·45
Puysegur Point ..	6·07	25	1·10	6·67	28·98	35·67
Half-moon Bay ..	7·00	21	1·10	4·85	21·06	24·22

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT OF WEEDY LAWN.

M. W. H., Whakoangiangi :—

My lawn has a lot of daisy, rib-grass, and another very small-leafed weed that takes root at all joints, has a very strong smell, and is dense. What is the best way to clean the lawn? In places I will need to fill up hollows with fresh earth.

The Fields Division :—

Daisies, rib-grass, and the strong-smelling dense weed, which is probably pennyroyal, are common weeds in many lawns. For autumn treatment it is advisable to first top-dress the lawn with a mixture of equal parts of superphosphate and nitrate of soda at the rate of 1 oz. per square yard from two to four weeks before treatment for the eradication of weeds. To eradicate the weed growth spray the lawn with one part arsenic pentoxide to eighty parts of water. Care should be taken not to saturate the lawn heavily, but merely to damp all vegetation, otherwise the grass may be burned too severely. At the season of the year when growth is very vigorous the strength of the spray may be increased to one of arsenic pentoxide to sixty parts of water. In the following spring if a few weeds remain the lawn should be again sprayed lightly, and about September it should be scratched with a sharp-toothed garden rake and any holes or bare patches levelled up with good clean soil free from weed-seeds and sown fairly heavily with a mixture of Chewings fescue and brown-top. Do not roll. Until the young grass in the sown patches has become strongly established, it is very necessary to keep the lawn quite short so that there will be no competition from the old-established grass round the edges of sown patches.

DRUGS IN TREATMENT OF STOMACH WORM IN CALVES.

INQUIRER, Otakiri :—

Could you inform me as to the relative merits of carbon tetrachloride and tetrachlorethylene for combating stomach worm in calves. I have used both the above in treating calves, and have also used bluestone solution and a mixture of kerol and raw linseed oil. All of the remedies mentioned have been more or less successful, but I have been told that the first two are rather dangerous.

The Live-stock Division :—

In comparing the efficacy of the drugs mentioned by you in the treatment of intestinal parasites of calves it cannot be claimed that any one drug possesses marked superiority over the others for the purpose indicated, and good results are obtained by the use of any one of them. It can, however, be stated that carbon tetrachloride is dangerous, as at times, and under certain conditions, the use of this drug gives rise to mortality. It is advisable, therefore, when using carbon tetrachloride first to try it on a few animals before dosing a large number. Tetrachlorethylene is said to be comparatively safer than carbon tetrachloride. In so far as the stomach worm is concerned, bluestone solution has been found to be quite as effective as the above-mentioned drugs, and whatever superiority is claimed for the latter refers to the treatment of parasites in the intestines. The most important factor in successfully dealing with this trouble in calves is the provision of extra nourishment to the calves by means of a little concentrate feeding. In this respect probably nothing can equal the giving of crushed oats and good hay. Without the adoption of extra nourishment by way of feed, it is questionable whether any medicine will prové entirely effective. Attention must also be paid to the provision of clean, fresh pasture for calves, avoiding, if possible, grazing them on paddocks which might be suspected of being previously contaminated by affected animals.

New Zealand Department of Agriculture.

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MILK-FED VEAL.

A PROFITABLE DAIRY SIDE-LINE.

W. M. WEBSTER, Veterinary Laboratory, Department of Agriculture, Wallaceville.

THE food consumed by any animal serves a threefold purpose. In the first place, a portion is utilized as fuel for the maintenance of body-heat. A further amount is expended in the production of energy. Finally, any surplus after the two preceding requirements have been met is stored as reserves of fat. The more an animal is exposed to cold and inclement weather, and the farther it has to travel in search of food, the greater will be its heat and energy requirements, and, since the capacity of its stomach is a constant factor, the less will be the surplus available for storage purposes. It follows, therefore, that any economies effected in heat and energy requirements will leave a greater surplus to be built up into reserves of fat. In the colder climate of the Northern Hemisphere farmers have long appreciated the economic importance of warmth, protection, and rest in the successful fattening and finishing of stock for the butcher. Thus the Irish pig-farmer, whose successful pig-raising is a byword, not infrequently has his substantially constructed fattening-pens constructed under the one roof. The pens are well bedded down with fern or other litter and ranged round the walls, while in the central space a slow-burning peat fire is kept continuously alight during the colder winter months.

The excellence of Sussex-fed fowls and French capons is known by repute the world over. The method of finishing is similar in either case, the birds being closely confined in semi-darkness and a warm atmosphere, with abundant food always before them, or they may even be forcibly fed. Similarly, cattle being fattened for the butcher are closely housed in warm barns, knee deep in dry litter. The result is the same in all cases—the animals or birds eat their fill of fattening meals and, encouraged by full stomachs and the warmth and comfort of their surroundings, spend most of their time between feeds in sleep. In other words, their heat and energy requirements are reduced to a minimum and the bulk of the food digested is rapidly piled up in fat reserves.

From the consumers' point of view a further advantage accrues from this system. Since the fattening animals or birds expend practically no muscular energy, their muscle-fibres become extremely soft, and the meat is in consequence much more tender and juicy.

In addition to the increased rapidity of the fattening-process and the improved quality of the meat there is a very substantial saving in time and also in the amount of foodstuffs consumed. Controlled feeding trials have demonstrated that, in securing a given increase in weight, the provision of adequate shelter and warmth may result in a saving of as much as from 15 per cent. to 18 per cent. of the total food-consumption.

Last spring Mr. P. A. Openshaw, a Taranaki dairy-farmer, applied the principles outlined above to the fattening of vealer calves. The experiment proved so far successful that the results are well worthy of consideration as exemplifying an alternative and profitable method of utilizing part of the milk-supply. The calves used in the experiment were ordinary Jersey-cross "bobbies" from the dairy herd. They were closely penned from birth onwards in snug enclosed pens and were fed all the whole milk they would consume, supplemented by a small quantity of linseed-meal The calves showed phenomenal increases in weight, and were sold to the butcher when from one to two months of age. The flesh met with a very ready demand, realizing 4½d. per pound dressed weight, and, needless to say, proved immeasureably superior to that of the ordinary runner calves. Eight calves were fattened during the spring months and all showed more or less uniformly satisfactory returns. In the case of the first four calves detailed records of the whole-milk consumption of each animal were kept. After making due allowance for the initial value of the calf, the litter used, and the linseed-meal consumed, the price realized for the meat showed a return of 10d. per pound of butterfat on the milk consumed. In the event of butter realizing more than this figure it would prove more profitable to supply the factory, but, conversely, the further the return for butterfat fell below 10d. the greater would be the margin of profit in calf-fattening. There is no doubt that, in view of the low factory returns prevailing during the past season, Mr. Openshaw's calves proved quite a paying side-line.

The data covering four calves are given in the table which appears below. In arriving at the costings it should be explained that the value taken for each calf was that placed upon it by the "bobby"

—	Value of			Whole Milk consumed	Equal to Butter-fat (4 0 per Cent. Test).	Age when slaughtered.	Dressed Weight of Carcass.	Value of Carcass at 4½d. per Pound.	Return on Milk consumed (preceding Column less Sum of Columns 1, 2, and 3).	Return per Pound Butter-fat.
	Calf.	Litter.	Linseed-meal							
	s d	s. d	s. d	lb.	lb.	Days.	lb.	s. d.	s. d.	d.
Calf 1 ..	5 0	3 6	4 0	1,020	40·8	50	126	47 3	34 9	10·2
Calf 2 ..	5 0	3 6	4 0	1,332	53·3	62	154	57 9	45 3	10·2
Calf 3 ..	4 6	3 6	4 0	1,125	45·0	54	119	44 7½	32 7½	8·7
Calf 4 .	4 0	3 6	4 0	550	22·0	28	84	31 6	20 0	10·9
Totals ..	18 6	14 0	16 0	4,027	161·1	194	483	181 1½	132 7½	9·9

buyer at the farm-gate and ranged from 4s. to 5s. according to the size of the calf. A fair quantity of rough hay from the stack tops and bottoms was used as litter. The cost of this has been debited at a flat rate of 3s. 6d. per calf—mainly to cover cost of cartage and handling, since it was practically valueless in itself. The total cost of the linseed-meal consumed came to 16s., which was apportioned equally between the four calves, since records of individual consumption were not kept. The meal was added to the milk from the end of the first week, commencing at the rate of one tablespoonful and gradually increased to ½ lb. per calf per day. The factory test for the herd during the period was generally 4·0 per cent., though it fell to 3·8 per cent. on one or two occasions. However, the higher test has been used as the basis of the costing calculations.

The average figures for the four calves thus show a return of practically 10d. per pound of butterfat on the quantity of milk consumed. Calf 3 proved a comparatively poor "doer," and so reduced the average slightly.

As already noted, records of the milk-consumption of the remaining four calves were not kept However, their ages and weights at time of slaughter were as follows 133, 128, 172, and 82 lb. dressed weights at 50, 50, 70, and 30 days respectively. The first group of calves consumed 4,027 lb. milk in 194 feeding-days, or an average of 20·7 lb. milk per calf per day Applying this figure to the second group of calves, it may be assumed that their total consumption of milk would be approximately 4,140 lb milk for the 200 feeding-days, equivalent to 165·6 lb butterfat at a 4·0-per-cent. test. If each calf in the second group be valued at 5s. and litter and meal as before, we arrive at a flat rate debit of £2 10s for the four calves Deducting this from the return from the meat (515 lb. at 4½d – £9 13s. 1½d.) this group of calves shows a return of £7 3s. 1½d for the consumption of 4,140 lb. milk, or 10·4d. per pound of butterfat.

The quality of the carcasses when dressed was of the highest order, and it would have been almost an impossibility to find any fault with them. The illustration (Fig. 1) of the carcass of calf 2 (154 lb. in sixty-two days) speaks for itself, and its study will convey more than a lengthy description. The quantity and quality of the kidney-fat is in itself a sure indication of the prime condition of the carcass.

On the data given it might be assumed that the younger calves killed at twenty-eight and thirty days respectively showed the best returns. This assumption must, however, be qualified by the fact that calf No. 4 proved the best "doer" of the eight right from the start. The last calf, on the other hand, was a large-boned Friesian animal obtained from a neighbouring herd, and did not do so well as some of the others. Its killing weight must therefore be discounted to some extent by the fact that its initial weight was considerably greater than that of the remaining calves in which the Jersey strain predominated. Furthermore, the butcher reported that while these two calves were of excellent quality, the carcasses did not contain the same proportionate amount of fat as the older calves.

The outstanding quality of the product was fully appreciated by the trade, and the higher price was obtained without any difficulty, and, had they been available, many more calves could have been disposed of at the same figure.

Since by no means the least important factor in the success of this "hothouse" rearing of calves lies in the provision of suitable quarters designed to provide the maximum warmth and comfort, due attention

FIG 1. CALF NO 2. 154 LB. DRESSED WEIGHT IN SIXTY-TWO DAYS.

must be given to this point: Any attempt to emulate these results is foredoomed to failure if the calves are merely shut up in a cold, damp shed. The essentials to bear in mind are: (1) The exclusion of all cold draughts; (2) the exclusion of as much light as possible; (3) the provision of a warm, dry bed. Any enclosed shed will serve the purpose, but if the weather-boarding is not draught-proof or if the walls are of iron construction, the studs should be lined with wire

netting to a height of about 5 ft. and the spaces between the outside wall and the netting packed with rough hay, fern, or other similar material. The pens should be then constructed against this "padded" wall. Each pen should measure approximately 4 ft. 6 in. by 3 ft., and be closely boarded. The dividing partitions need to be carried up to a height of 5 ft. and the whole roofed with more wire netting on which a layer of rough hay, &c., is placed. The front wall should be carried up to a height of approximately 3 ft. 6 in. and the gap of 18 in. intervening between it and the roof utilized for feeding and bedding the calf. It may be closed by a curtain of old sacking, if necessary, in order to exclude further light. A generous bed of litter should be supplied in the first instance, and the pens not cleaned out, but further litter added on top from day to day as required.

The calves require to be fed twice daily and allowed to drink as much as they wish. One calf was put on thrice-daily feeding for a period, but it was found that it did not consume any more milk and did not thrive any better than on the twice-daily feeding. Another experiment using skim milk and slightly increasing the supplementary feeding of meal also proved unsatisfactory.

At the present time, in view of the low prices prevailing for dairy-produce and the threatened overproduction, there should be much to recommend this method of fattening vealer calves. It will divert a certain quantity of milk from the factories into a channel which, with a negligible initial outlay, should prove a profitable side-line. Without going into the possibility of an export trade and considering only the local market, one hundred thousand calves fed under this system would utilize milk equivalent to approximately 2,200 tons of butterfat, and at the same time show a return of 1½d. to 2d. per pound more than the factory pay-out at current rates.

In conclusion, it may be as well to reiterate that the whole secret of the success of this system lies in providing proper fattening-pens in which the warmth, comfort, and semi-darkness encourage the calf to eat, sleep, and grow fat in the minimum time and on the smallest quantity of food.

Acknowledgments are due to Mr. Openshaw for the careful manner in which he kept the records and placed them at the writer's disposal and also for the courteous manner in which he always received the various officers of the Department who frequently visited and inspected the calves during the course of the experiment.

The Fields Superintendent, Palmerston North, reports that a poor, light property, of under 400 acres, near Ongaonga, Hawke's Bay, previously carried 450 ewes, and, with the assistance of 20 acres of rape and 30 acres of swedes, the owner managed to get most of the surplus stock off fat by the middle of June. He has been introducing subterranean clover during the last six years in mixtures, and now runs two ewes to the acre and fattens all surplus stock before the subterranean clover dries up in summer. One paddock of 30 acres sown with a very heavy proportion of subterranean clover carried 150 ewes and lambs last season, and it is stated they could not "hold" the growth.

CHEWINGS FESCUE.

THE PROBLEMS OF GERMINATION AND PURITY AND THEIR INFLUENCE ON GREENKEEPING AND COMMERCE IN THE UNITED KINGDOM.

I. G. LEWIS, St. Ives Research Station, Bingley, Yorkshire, England.

CHEWINGS fescue plays an important part in the formation of fine sports turf, and the bulk of the seed is utilized for that purpose. At the outset it may be stated that until comparatively recent years the chief importing countries of this seed were the United States and Canada. That the United Kingdom can now be regarded as an important customer is revealed by the import figures for the past five years. These show that over 600 tons of Chewings fescue were imported by the United Kingdom during that period. In 1932 the tonnage imported was the highest in the history of this country, but, unfortunately, the germination, almost without exception, fell very rapidly. This drop in germination after arrival in the United Kingdom is well known, and has been attributed to various causes, whilst furthermore the trouble is more widespread in some years than in others. The following table is of considerable interest and importance, as it illustrates the germinating capacity which exists at the time of shipment as well as on arrival of the same lots in the United Kingdom. These figures have been obtained as a result of communication with the largest importers in this country.

Table 1.

Percentage of Germination at Time of Shipment.	Percentage of Germination after Arrival (Official Seed-testing Station, Cambridge).
97	66
94	57
94	86
90	75 August. 45 March.
96	50
90	90 September. 72 March.
90	64
95*	75

It will be observed that practically all these cases show a marked drop in germination on arrival here. Not only has this loss in germination during shipment to be contended with, but frequently there is also a rapid deterioration during storage after arrival. In the last quoted example* the germination in six months fell to 22 per cent., and, finally, after a further three months, registered only 7 per cent. Many other similar cases could be recorded, all of which have incurred big financial losses. On the other hand, the 1933 crop has not suffered in this way and up to the present time the germination has been well maintained. Certain seed houses report no germinations below 90 per cent.

The outcome of all this uncertainty is an increasing reluctance on the part of the importer to handle the seed. One firm writes as follows :—

" We do not intend to stock New Zealand Chewings fescue, because it loses its germination power so quickly. This fact is not understood by the golf clubs here, who expect to be able to purchase this variety at any time of the year with a very high germinating-capacity."

Not only does the problem of germination of Chewings fescue require investigation, but there is need for much closer attention in the matter of purity. Rarely is the seed of this species free from seeds of perennial rye-grass and Yorkshire fog, both these being highly objectionable lawn-weeds. In the production of high-class lawns and turf to sow seeds which are contaminated with even small amounts of these impurities is to court disaster. The reasons for this are not very far to seek. First and foremost, where lawn seeds are concerned, the method whereby the impurities in a seed-sample are expressed does not and cannot give one a true conception of the degree of contamination. To report that 1 per cent. by weight of a seed sample consists of a given impurity is one thing; to know what this means in number of seeds of that impurity, is altogether another. For instance, in the case of the impurities mentioned: if a sample of Chewings fescue containing 0·1 per cent. of perennial rye-grass as an impurity is sown at 3 oz. per square yard, in effect we have introduced in our sowing no less than forty-two seeds of perennial rye-grass to each square yard. Assuming the impurity to be Yorkshire fog and the rate of seeding and the percentage of impurity as before, the final result will be the introduction of approximately 170 seeds of this undesirable species to each square yard. The potential danger from weed impurities, even in small amounts, is thus considerable.

The second reason is self-obvious — the disfigurement caused by the presence of even small numbers of coarse-leaved and tall-growing plants in an otherwise fine, close-growing turf. No effort, therefore, should be spared in securing samples free from the species mentioned, since the high rate of seeding involved in the production of fescue turf renders an insignificant amount of impurity a matter of disturbing importance. In further connection with this it is interesting to report on a series of six plots sown down at the Research Station in 1931. Red fescues alone from varying sources were utilized, the plots being adjacent.

Table 2.

Plot No.	Purity of Seed.	Percentage of Ground covered by Yorkshire Fog, January, 1934.
	Per Cent.	
1	82·69 (no Yorkshire fog)	Trace.
2	88·4 (no Yorkshire fog)	Nil
3	97·7 (no Yorkshire fog)	1·0
4	92·6 (0·1 per cent. Yorkshire fog)	20·0
5	98·5 (no Yorkshire fog)	Nil
6	98·6 (no Yorkshire fog)	2·5

It will be seen from the above that in five out of the six plots there is little or no Yorkshire fog. However, in plot No. 4 where the impurity

of Yorkshire fog was only 0·1 per cent.—an apparently negligible amount —20 per cent. of the ground is now covered with plants of Yorkshire fog, which factor ruins it for the purpose of golf-green turf. That the Yorkshire fog impurity in the seed is chiefly responsible for the condition of this plot is evident, and such a view is supported by numerous other trials in progress, all of which reveal the devastating effects of small amounts of impurities, particularly Yorkshire fog and perennial rye-grass, when the seed rate is frequently in the necessary region of 9 cwt. per acre.

It is this feeling of insecurity in the employment of Chewings fescue that is so disturbing. Firms are showing reluctance to concern themselves with this species, and those whose duty it is to give advice on seeds and seeds mixtures for sports turf purposes run the risk of involving their clients in financial loss and unsatisfactory results. The appearance and value of a turf produced with seed of low germination and contaminated with weed species must obviously be far from good, and, regarding the impurities, it should be remembered that these, when once established in the turf are difficult and costly to remove.

It needs to be realized more fully by the growers and exporters in the Dominion that Chewings fescue is utilized chiefly for the production of lawns and sports turf and seldom for agricultural purposes. In this sphere this species has been extensively used as an ingredient in seeds mixtures, primarily with the object of acting as "nurse" to the slowly developing bent grasses which are the foundation of all first-class greens and lawns. Moreover, Chewings fescue mingles exceedingly well with bent grass such as New Zealand bent, and undoubtedly adds considerably to the general character of the turf. It is when we consider Chewings fescue in this role of "nurse" crop that we are confronted with perhaps the weakest link in the chain of its usefulness; a weakness which is slowly undermining its popularity with both importers and users in the United Kingdom. The ability to be quickly "off the mark" when sown is essential in a species to be sown in conjunction with New Zealand bent. The *Agrostis* species—foundation of the mixture and the turf to be formed—makes but slow progress in the initial stages and, in addition, is frequently set back by seedling disease. It is obvious, therefore, that unless Chewings fescue can show a final germination of at least 90 per cent. with the greatest proportion of this in seven to ten days, it must fail to "fill the bill."

Vastly different will be the result of Chewings fescue imported in 1933. There can be no lack of vigorous seedlings making their appearance quickly through the ground from seed which arrives in this country growing 95 to 99 per cent., and when tested at the time of writing, (February) can show in seven days a germination of 86 per cent. with a final growth of 94 per cent.

Experiments to elucidate these difficulties have not been as extensive as could be desired, or indeed as would appear to be warranted by the nature and the importance of the matter. In 1925 the Seed Analyst at Wellington reported on a series of experiments designed to investigate which factors were responsible for the shipment troubles, and, as a result, recommendations to growers were put forward. These lay chief

emphasis on the need for delayed cutting, together with stacking in order that mature seed be obtained. It may also be reported that shipments have been made in cool storage to test the validity of the view that tropical temperatures and high humidity conditions operating on ship-board are responsible for the deterioration of the seed in transit. Despite these recommendations and investigations 1932 proved the most disastrous year for importers, merchants, and greenkeepers in the United Kingdom.

Whilst it is not intended to make definite suggestions here regarding those problems which need further investigation, certain facts in the production of seed generally, and Chewings fescue in particular, are not perhaps without interest and significance. The tendency for seed harvested on the under-ripe side to "go off," particularly if subjected to unfavourable storage conditions, is well known. The experiments of Jacques and Corkill with crested dogstail (*Journal of the Ministry of Agriculture*, May, 1932) clearly show that high vitality and high germination are coincident with maturity of the seed, and this condition is linked with seed colour. The authors cited indicated that the immaturity of much New Zealand crested dogstail seed with consequent lack of vitality may be the cause of its inability to withstand shipment overseas. It may be that this same factor operates in the case of Chewings fescue and undoubtedly investigations into this matter should be made. That any investigations must of necessity be initiated in New Zealand is obvious. The fact that different parcels of seed on the same boat, all of similar high growth when shipped, show different germinations on arrival here, and that seed carried in ordinary cargo has arrived with equally good growth as those shipped in cool storage seem to indicate that the factors responsible operate prior to shipment.

In disposing of the difficulties presented, we extend to investigators in the Dominion a hearty invitation to co-operate with this country, particularly in undertaking the necessary tests after shipment The Chief Officer of the Official Seed Testing Station has expressed his willingness to co-operate in every way possible. Finally, the solving of the problems concerned requires concerted and immediate action. The outcome of this, it is hoped, will be the widespread adoption by growers of methods which will ensure elimination of the impurities which so reduce the value of their seed crops, and at the same time by solving the problem of depleted vitality after shipment, renew that confidence amongst traders and greenkeepers in the United Kingdom which this species of grass undoubtedly deserves.

The Field Instructor, Christchurch, reports that at Riccarton an area of lucerne was sown three years ago on land which was limed at the rate of 1 ton carbonate per acre A further ton of lime per acre was applied later, but the lucerne was pale in colour and did not flourish until inoculated soil at 4 cwt. per acre was applied in 1932 season. The stand is now an excellent one.

The Instructor in Agriculture, Oamaru, reports that at Papakaio ryecorn was sown on light soil about the end of April with a seeding of 2½ bushels per acre, the total area sown being 40 acres. From it eight hundred ewes had grazing for two hours per day after turnips during most of the month of September. The crop must be grazed fairly short all the time, as if allowed to come away too far it becomes coarse. The farmer was well pleased with it owing to the fact that it can be sown later than Cape barley and also because it withstands very hard frosts.

DETERIORATION PROBLEMS IN NEW ZEALAND CHEWINGS FESCUE.

N. R. Foy, Seed Analyst, Plant Research Station, Palmerston North.

DETERIORATION in the germination capacity of Chewings fescue seed during shipment from New Zealand to northern countries has for many years been a constantly recurring trouble, yet, in spite of this fact, the annual export totals have remained reasonably steady. The total annual export for the years 1926-33 is shown in Table 1.

Table 1.—Chewings Fescue: Export, 1926–33.

—	United Kingdom.	United States of America.	Canada.	Total.
	Tons.	Tons	Tons	Tons
1926	192	425	50	696
1927	168	521	50	870
1928	107	619	75	851
1929	119	544	109	842
1930	77	435	50	640
1931	143	475	96	705
1932	187	401	53	672
1933	294	592	57	966

American buyers appear to have accepted Chewings fescue as a characteristically delicate and short-lived seed, and, although periodically complaints have followed unsatisfactory deliveries, particularly in unfavourable production seasons, the demand has been well sustained. Naturally, with the continuance of a retail demand, the importers meet it, and as far as the American retail market is concerned no serious complaint appears to have been made. Presumably Chewings fescue is regarded as low-germinating species, and therefore a high-germination capacity is not expected.

Until the advent in Great Britain of green-keeping research, the same remarks might well apply to the British trade, but investigation into the relative values of various fine-leaved turf grasses has disclosed the fact that although Chewings fescue is a desirable turf constituent much of the seed retailed is of a very inferior quality and, by virtue of this fact, of little value in sports-turf establishment.

It has been made quite plain that if Chewings fescue can be landed in Great Britain with a sufficiently high vitality to permit of its retaining a reasonable high-germination capacity up to the time of retail sales—say, six months—then the prospects of an extension of the present trade are most encouraging. On the other hand, it is equally clear that if the trade continues on the present lines those in a position to do so will not be prepared to recommend unconditionally the use of the seed, and this will be obviously to the detriment of the industry in New Zealand. The fact that the various forms of European fescues are at present

under investigation in England, although not necessarily with the one idea of replacing New Zealand seed, will tend to create an independent attitude on the part of British consumers.

The attitude of the consumer section of the American trade is not so clearly defined; one assumes that the retail trade is satisfied with present conditions, but it is very probable that if the quality of the seed moving on to the retail markets was of a known higher standard the American demand would be improved. Dissatisfaction with deliveries of New Zealand seed was no doubt responsible for several attempts to grow Chewings fescue in several States, and, although these attempts were not attended by any great success, they are not without significance.

It will be agreed, therefore, that a somewhat critical stage has been reached in the history of an industry which, although not nationally important, is a profitable phase of farming in the southern districts, and, furthermore, in these days of economic stress any industry, even although relatively of small dimensions, which exists comparatively without competition, should be developed to its utmost capacity.

Previous Investigational Work

Prior to 1925 many theories as to the cause of deterioration of grass-seed during shipment were put forward both in New Zealand and abroad. Most of these were investigated and, together with the results of some experimental work carried out with Chewings fescue, reviewed by the writer in this *Journal*, 1925.* From the the data presented it was concluded that, contrary to general opinion, deterioration was due to unfavourable shipment conditions to which Chewings fescue and crested dogstail were peculiarly susceptible, that the unfavourable conditions were associated with high degrees of temperature and humidity. Furthermore, it was recognized that the degree of deterioration was controlled to some degree by seed-vitality, which in turn is influenced to a marked degree by a number of factors operating during production, the chief of which were seed maturity at harvesting, maintenance of soil-fertility to a standard of fescue requirement, and the renewal of worn-out pastures.

So far as the production of fescue is concerned, in the light of further experience, in the opinion of the writer, these views still hold good. Well-matured seed harvested from vigorous healthy stands invariably ships and stores well under average conditions, and in normal production years, by its superior quality, is distinguishable when shipped with other lines under identical conditions.

Causes of Deterioration.

The fact that the germination capacity on arrival of several lines shipped on the same steamer is not always consistently high or consistently low has led to the suggestion that the cause or causes must be associated entirely with production, for the reason that were transit conditions responsible all lines would deteriorate

* *New Zealand Journal of Agriculture*, Vol. XXXI, 356–370.

to an equal degree. An acceptable theory for this inconsistency has already been given, and of far greater significance is the fact that invariably there are wide discrepancies between the germination capacities of exported seed and of portions of the same lines retained under normal storage in New Zealand. Such discrepancies naturally can be accounted for only by deterioration during shipment and, as suggested previously, are undoubtedly due to excess of heat and/or humidity obtaining in the ship's hold. The effect of these conditions on most short-lived seeds is known to every seedsman, who, wherever possible, provides dry, well-ventilated space for bulk storage. The conditions under which seed is shipped from one hemisphere to the other are, in most cases, the antithesis of shore conditions—hold temperatures particularly in the tropics are known to be much above normal and the relative humidity of the air surrounding the seed following temperature increases must be unduly high. Unfortunately, no reliable data concerning the temperature and relative humidity of ships' holds are available, but from various observations it is known that both conditions are almost invariably excessive.

The high relative humidity of the storage atmosphere is due partly to the release of water vapour from the seed itself, and is partly, in some instances, provided by associated cargo. At all events, sufficient moisture is carried by the seed to exercise harmful effect when temperatures are increased. All seeds naturally contain a certain amount of moisture, the amount varying with the type of seed. Grass-seeds have, in most species, attached glumes, and a proportion of the moisture content is held by the glumes. Therefore the percentage moisture content of a sample of seed such as Chewings fescue is actually disproportionally high and is more readily released than is the moisture held by the grain. It is probably the glume moisture which is responsible for the rapid changes in the relative humidity of the storage air under the influence of temperature changes.

In order that some information could be obtained relative to the effects of high temperature on viability, laboratory experiments were instituted which showed that excesses of both conditions effected rapid deterioration, that an excess of one condition with the other at normal caused a slower deterioration, and that, provided one condition was reduced below the normal level, the other could be raised to excess without harmful result. The results of this experiment are presented in Table 2.

For the purposes of the experiment seed from one line was divided into three portions; for the first the moisture content was reduced by drying to 5 per cent., for the second the moisture content was allowed to remain at normal (13 per cent.), and for the third the moisture content was increased to 20 per cent. Seed from each of the three portions was then placed in sealed glass vessels and a number of each stored at constant temperatures of 30° C., 40° C., and 50° C., and one series at room-temperatures (16 to 20 C.). At regular intervals tubes from each storage temperature were removed and the contained seed tested.

Table 2.—Chewings Fescue: Results of Storage of Seed of Low and High Moisture Content under Different Termperatures. (Initial Germination Capacity of Seed, 98 per Cent.)

Period of Storage, in Days ..		1.					6	7	10	14	21	35	42.
Storage Temperature	Moisture Content.	Germination Capacity (Percentage)											
°C.	Per Cent												
50	5	97	..	98	..	97	..	97	..	98	97	98	97
50	13	96	90	86	54	15	11	9	2	..	..	..	..
50	20	94	70	57	19	..	..	..	..	..	..	..	..
40	5	98	..	96	..	96	..	97	..	98	98	96	98
40	13	96	97	91	93	92	84	73	67	38	21	15	10
40	20	94	93	87	85	86	73	66	43	12	2	1	..
30	5	98	..	96	..	97	..	98	99	98	98	97	96
30	13	97	96	96	94	95	88	85	84	82	85	79	75
30	20	95	94	90	88	81	82	79	76	57	39	10	5

Period of Storage, in Months		1	2.	3	4	5	6	7.	8	9	10	11	12.
Room Temperature	Moisture Content	Germination Capacity (Percentage).											
°C.	Per Cent												
16–20	5	98	99	96	97	96	98	97	95	96	95	87	96
	13	90	96	97	99	91	93	93	85	81	75	68	60
	20	97	97	93	89	78	57	10	..	..	..	..	..

It is not claimed that the conditions to which this seed was exposed were an exact replicate of conditions existing in the hold of a steamer, but it is considered that a temperature of approximately 40° C (86° Fah.) for some days is an estimate of the conditions prevailing in a ship's hold during the passage through the tropics. Examination of Table 2 shows that at this temperature seed with a normal moisture content of 13 per cent. shows signs of deterioration on the third day and by the seventh day has lost over 20 per cent. In the same period the germination capacity of seed with a moisture content of 20 per cent. had fallen to 66 per cent. Referring now to the series at 50° C. (122° Fah.), it is seen that in five days seed with normal moisture content has fallen to 15 per cent. germination, that with a 20 per cent. moisture content has deteriorated completely, while the samples with a reduced moisture content of 5 per cent are unaffected at the expiration of the experiment in forty-two days. The series at room-temperature was conveniently continued for a period of months, no deterioration being observed until the third month, when the seed with a 20 per cent. moisture content showed a slight loss. Further comment appears to be unnecessary, as it is the writer's contention that a clear case has been made against associated conditions of temperature and humidity. It may be doubted whether hold-temperatures ever do exceed 30° C., but actual experiences would tend to confirm the belief that they probably exceed 40° C. For example, shipments have been delivered at east

coast American ports showing a germination capacity of less than 10 per cent. Subsequent investigation showed that several periods of excessive temperature had occurred.

Laboratory experiments have shown that seed that has deteriorated rapidly under excessive temperature to, say, 70 per cent. does not continue to do so with the return of normal conditions, the fall continuing at a rate slightly higher than normal. In fact, even if deterioration occurs to a slight degree only, subsequent storage losses appear to be accelerated, which could be accounted for by the weakening effect of high temperatures on viable seed.

Although normal losses in stored seed must be expected, complaints of heavy storage losses in England would appear to be justified. At the same time, however, it is very doubtful whether it could be claimed that Chewings fescue is invariably stored under conditions requisite for this type of seed. Humidity is likely to be high in the northern winter, and interior temperatures higher than 20° C. (68° Fah.) would tend to accelerate deterioration.

One point calling for brief mention is the variation in seed quality (as evidenced by vitality) from season to season. Every two or three years an abnormally good or abnormally poor production season occurs and occasionally one good season succeeds a poor one. The 1932 and 1933 harvesting seasons were typical in this respect; seed for 1932 shipped very unsatisfactorily and deteriorated rapidly after delivery, whereas 1933 seed shipped and stored remarkably well. The explanation seems to be that in some years climatic conditions are such that seed can remain longer in head and become thoroughly mature before harvesting, whereas in the less favourable years the seed "ripens" more quickly and has to be harvested to prevent losses by seed fall. Overseas buyers should therefore understand that these often very marked quality variations are entirely seasonal and beyond control. It should also be mentioned that seed produced in an "off" season deteriorates at a rate distinctly higher than average while in storage in New Zealand.

Remedial Measures.

The general overseas opinion appears to be that the prevention of transit losses lies in improvement in production methods. To a limited extent this is true, as repeated reference in this article to seed-vitality will testify. The production of seed of the highest possible vitality is most essential, and to this end nothing but thoroughly mature seed saved from healthy, vigorous stands should be saved and offered for the export trade. Seasonal conditions will at times tend to nullify growers' efforts in this respect, but seed of heavy weight and high quality must in all seasons be the growers' ideal.

It has been stated previously, however, that the production of high-quality seed may be regarded as only a partial remedy, and an insecure one at best. It is therefore very clear that as transit conditions are responsible for deterioration that either these conditions must be altered or that seed be prepared to withstand conditions unfavourable to it.

It has been shown that associated conditions of high temperature and high humidity are directly responsible for transit losses, and that provided one of these conditions is reduced below normal the other may rise to abnormal levels without causing harm. Two alternatives then present themselves, either cool storage or the reduction of humidity by artificial drying of the seed itself, both of which possess merits and demerits.

Cool storage has already been put into operation in 1933, when, following the circulation among exporters of data included in Table 2, which was posted overseas to importers, an immediate demand was created for cool-stored shipments. This was filled so far as suitable and available insulated chambers would permit, but, unfortunately, purely from the experimental point of view, the high quality 1933 seed in many instances carried almost equally as well in hold storage as in cool storage. Nevertheless, the differences in germination capacities of seed shipped under either one of the two methods were significantly in favour of cool storage. There are, however, attendant disadvantages, the chief of which perhaps is the difficulty in securing suitable space on conveniently sailing steamers. The trade is not sufficiently large to warrant the provision of special accommodation for seed, and shipments have to be adjusted to suit what is offering. Secondly, normal deterioration appears to continue during the period of cool storage—admittedly at a slightly slower rate—and is also not in any way prevented during storage after delivery—an important point.

Artificial drying prior to shipment has not yet been attempted commercially with Chewings fescue, the opinions expressed in this article regarding its efficacy being based entirely on information gained from experimental drying on small-scale shipments made in co-operation with two overseas seed-testing stations—the Official Seed Testing Station for England and Wales at Cambridge, England, and the Division of Seed Investigations, Department of Agriculture, Washington, D.C., United States of America.

Investigational Work

It will be advisable, before any discussion as advantages or otherwise of artificial drying is attempted, that certain experiments be outlined and the results obtained therefrom presented and commented upon. Some of the experiments have a bearing also upon cool storage.

Experiment 1: To determine the Effect of Artificial Drying on Commercial Seed shipped to England.

From twelve commercial lines sufficient seed was used to provide 10 lb. of experimental samples—divided into four groups, A, B, C, and D, which were treated as follows:—

A. Dried to approximately 5 per cent moisture content and packed in lined sack.
B. Dried same as A—packed in unlined sack.
C. Undried—14–15 per cent. moisture content—packed in lined sack.
D. Undried—14–15 per cent. moisture content—packed in unlined sack.*

All seed was shipped in October, 1932, to the Official Seed Testing Station, Cambridge, England. Numbers 1 to 6, direct to England, arrived 29th December, 1932. Numbers 7 to 12, via the Australian coast and transhipment at New York, arrived 27th January, 1933. Samples of all lots were retained in storage in New Zealand as controls. Tabulated results are shown in Table 3.

* Normal shipment conditions.

Table 3.—Chewings Fescue (1932 Season): Trial Shipments of Dried and Undried Seed to Cambridge, England, September, 1932.

	September, 1932.		January, 1933.			January, 1933.			
Mark	New Zealand, when packed.		Cambridge, on Arrival		Loss during Transit.	New Zealand Controls.		Loss during Storage in New Zealand.	Approximate Loss due to Shipment.
Column 1.	Column 2.	Column 3.	Column 4.	Column 5.	Column 6	Column 7.	Column 8		
	Moisture Content	Germination.	Moisture Content	Germination.	Germination.	Moisture Content	Germination.	Column 9.	Column 10.
	Per Cent.	Per Cent.	Per Cent	Per Cent	Per Cent	Per Cent.	Per Cent	Per Cent.	Per Cent.
A 1	6·7	92	9·99	82	10	9·9	86	6	4
2	5·0	94	9·50	89	5	9·3	91	3	2
3	5·5	91	9·19	75	16	9·2	80	11	5
4	6·0	96	9·40	94	2	9·5	96	0	2
5	5·3	94	9·25	88	6	9·5	96	0	6
6	6·1	94	9·32	92	2	9·2	95	0	2
7	4·2	93	9·60	89	4	8·8	87	6	0
8	6·2	98	9·99	95	3	9·7	96	2	1
9	4·4	94	9·35	87	7	9·3	92	2	5
10	7·1	97	9·93	90	7	9·2	90	7	0
11	5·6	96	9·72	93	3	9·7	94	2	1
12	5 1	92	9·57	80	12	9·4	79	13	0
B 1	6·7	94	14·40	46	48	11·4	84	8	40
2	5·0	94	14·07	61	33	11·3	91	3	30
3	5·5	91	14·47	48	43	11·1	71	20	23
4	6·0	96	14·73	85	11	11·3	94	2	9
5	5·3	94	13·35	73	21	11·1	95	0	21
6	6·1	94	13·45	66	28	12·0	89	5	23
7	4·2	93	13·63	59	34	10·9	83	10	24
8	6·2	98	13·12	75	23	11·4	97	1	22
9	4·4	94	13·16	75	19	11·0	86	8	11
10	7·1	97	12·88	68	29	11·5	95	2	27
11	5·6	96	13·10	72	24	11·4	90	6	18
12	5·1	92	13·18	59	33	11·2	74	18	15
C 1	15·2	92	15·63	32	60	13·0	56	34	26
2	15·8	95	15·82	46	49	13·4	74	21	28
3	15·2	90	15·52	36	54	13·2	66	24	30
4	15·3	97	15·61	70	27	13·0	94	3	24
5	15·5	97	15·58	58	39	13·1	85	12	27
6	15·1	96	15·45	54	51	12·8	75	21	30
7	14·8	91	14·63	30	61	12·8	67	24	37
8	15·3	98	14·93	42	56	13·1	76	22	34
9	15·6	94	15·14	28	66	13·2	73	21	45
10	15·2	97	14·85	38	59	13·1	83	14	45
11	13·8	97	14·88	45	52	13·2	82	15	37
12	14·1	88	14·68	31	59	13·0	68	20	39
D 1	15·2	92	16·03	38	54	12·5	79	13	41
2	15·8	95	16·05	57	38	12·4	87	8	30
3	15·2	90	15·49	46	44	12·3	72	18	26
4	15·3	97	15·67	75	22	11·9	92	5	17
5	15·5	97	15·33	72	25	12·4	83	14	11
6	15·1	96	15·27	52	44	11·6	83	13	31
7	14·8	91	15·38	49	42	12·2	79	12	30
8	15·3	98	15·25	64	34	12·2	94	4	30
9	15·6	91	15·40	46	45	12·2	83	8	37
10	15·2	97	15·14	59	38	12·3	87	10	28
11	13·8	97	15·35	54	43	12·3	87	10	33
12	14·1	88	14·85	40	48	12·3	71	17	31

From a study of column 6 it is obvious that the transit losses for the A lines were quite inconsiderable compared with those for B, C, and D, which, irrespective of the shipment route, lost heavily. The storage losses in New Zealand (column 9) for the A lines are approximately equal to the transit losses even for the three low vitality lines A 1, 3, and 12, but considerably less than the losses in B, C, and D. The heaviest falls are shown by C (undried—lined sack), which are undoubtedly due to the fact that the seed was packed with rather a high moisture content (15 per cent.) and that during subsequent rises in temperature this moisture has been unable to escape. Although the moisture content of the shipped C lines, as would be expected, remained constant, a fall of approximately 2 per cent. is shown for the New Zealand controls, due probably to the fact that when samples were drawn and weighings made the atmospheric humidity was low and immediate moisture losses occurred.

Upon the completion of the first series of tests at Cambridge all samples were placed in storage and further tested in three months and again in six months. The results of these two series of tests, together with those for the New Zealand controls, are tabulated in Table 4.

Table 4—Chewings Fescue (1932 Season) Storage Results on Trial Shipments to Cambridge, England

(A, dried; lined sack B, dried; unlined sack C, undried, lined sack. D, undried, unlined sack.)

Mark.	Germination Capacity				Deterioration				Relative Shipment and Control Samples.
	New Zealand, when packed, September, 1932.	England, on arrival, December, 1932.	England, Three Months' Storage April, 1933.	England, Six Months' Storage, August, 1933	During Transit	England, during Storage, December to August	England, Total Transit plus Storage.	New Zealand, Controls, October, 1932, to August, 1933	
	Per Cent.	Per Cent.	Per Cent.	Per Cent	Per Cent	Per Cent	Per Cent.	Per Cent.	Per Cent
1 A	92	82	82	71	10	11	21	15	6
B	94	46	46	35	48	11	59	32	27
C	92	32	28	20	60	12	72	51	21
D	92	38	36	26	54	12	66	42	24
2 A	94	89	88	81	5	8	13	12	1
B	94	61	60	42	33	19	52	30	22
C	95	46	38	33	49	13	62	47	15
D	95	57	52	45	38	12	50	32	18
3 A	91	75	72	73	16	2	18	17	1
B	91	48	44	37	43	11	54	45	9
C	90	36	25	13	54	23	77	58	19
D	90	46	35	35	44	11	55	46	9
4 A	96	94	94	88	2	6	8	4	4
B	96	85	81	77	11	8	19	11	8
C	97	70	61	61	27	9	36	25	9
D	97	75	68	62	22	13	35	17	18
5 A	94	88	90	88	6	0	6	5	1
B	94	73	72	70	21	3	24	14	10
C	97	58	55	48	39	10	49	34	15
D	97	72	66	62	25	10	35	20	15
6 A	94	92	89	78	2	14	16	7	9
B	94	66	57	54	28	12	40	26	14
C	96	45	31	23	51	22	73	53	20
D	96	52	45	33	44	19	63	34	29

Table 4—continued.

Mark.	Germination Capacity.				Deterioration.				Relative Shipment and Control Samples.
	New Zealand, when packed, September, 1932.	England, on arrival, December, 1932.	England, Three Months' Storage, April, 1933.	England, Six Months' Storage, August, 1933.	During Transit.	England, during Storage, December to August.	England, Total Transit plus Storage.	New Zealand, Controls, October, 1932, to August, 1933.	
	Per Cent.	Per Cent.	Per Cent	Per Cent.	Per Cent	Per Cent.	Per Cent.	Per Cent.	Per Cent.
7 A	93	89	81	82	4	7	11	11	0
B	93	59	52	48	34	11	45	28	17
C	91	30	24	16	61	14	75	45	30
D	91	49	47	37	42	12	54	29	26
8 A	98	95	94	92	3	3	6	7	1
B	98	75	65	60	23	15	38	23	15
C	98	42	29	26	56	16	72	45	27
D	98	64	55	46	34	18	52	26	26
9 A	94	87	88	91	7	4	3	8	5
B	94	75	69	64	19	11	30	14	16
C	94	28	24	16	66	12	78	41	37
D	91	46	48	36	45	10	55	30	25
10 A	97	90	88	86	7	4	11	12	1
B	97	68	74	67	29	1	30	26	4
C	96	38	33	25	58	13	72	37	35
D	97	59	56	49	38	10	48	27	21
11 A	96	93	91	85	3	8	11	9	2
B	96	72	66	61	24	11	35	23	12
C	97	45	34	25	22	20	72	43	29
D	97	54	52	42	43	12	52	31	21
12 A	92	80	80	79	12	1	13	13	0
B	93	59	54	50	34	9	42	34	8
C	89	51	30	21	58	10	67	43	34
D	88	40	38	26	48	14	62	40	32

It is evident that transit deterioration does not continue at the same rate after the seed is taken into storage and that after a period of six months only the A lines (dried, in lined sacks) show a germination capacity which might be considered reasonable for merchantable seed. It may be observed also that there is some inequality among the different lines of seed, and that, although storage conditions were identical, the degree of fall is by no means consistent. In this respect the best lines are Numbers 4, 8, and 11, and the three poorest Numbers 1, 3, and 12. All these lines were, of course, provided by the 1932 harvest, which, as previously stated, was a notoriously poor one. Even under storage in New Zealand, deterioration for all lots was more rapid than was expected.

As far as the A lots are concerned, it is probable that moisture was taken up during the short periods occupied in sampling, and that the fall in subsequent months would partly be due to this fact.

Experiment II : To ascertain Effect of Cool Storage.

Three full sacks of 1932 seed were shipped in January, 1933, to the United States Department of Agriculture at Washington. One sack (C 1) was lined with a commercial moisture-proof lining and shipped in cool storage, the second (C 2) without lining in cool storage, and the third unlined in hold storage. Test results are shown in Table 5.

Table 5.—Chewings Fescue (1932): Germination, 89 per Cent.; Moisture Content, 14·1 per Cent.; Experimental Shipment of One Line, Cool and Hold Storage, January, 1933.

Mark.	Storage during Shipment.	On Arrival, United States of America.		Loss in Germination during Transit.	Loss in Germination in New Zealand Controls.
		Moisture Content.	Germination.		
		Per Cent.	Per Cent.	Per Cent.	Per Cent.
C 1	Cool storage: Lined sack	15·3	81	8	6
C 2	Cool storage: Unlined sack	15·2	81	8	7
C 3	Hold storage: Unlined sack	13·5	64	25	7

As the seed was twelve months old when shipped and was rather below average in germination at that time, a loss of more than 25 per cent might have been expected. Under cool-storage conditions, however, the transit loss was no greater than for the controls. The use of a lining in C 1 was not justified by the results.

Experiment III: To ascertain Effect of Cool Storage—Extension of Experiment II.

In co-operation with a New Zealand exporting house, arrangements were made for a commercial shipment of 1933 seed to be sampled on arrival in the United States of America and samples tested at the United States Department of Agriculture at Washington. The shipment was divided into four and shipped as shown in Table 6.

Table 6.—Chewings Fescue (1933 Crop). Commercial Shipment, May, 1933, Cool Storage and Hold Storage—Samples tested at Washington and New Zealand (Germination at Time of Shipment, 98 per Cent.)

Mark.	Storage during Shipment.	On Arrival.	
		Moisture Content.	Germination.
		Per Cent.	Per Cent.
WO-A	Refrigerating-chamber, 18° F. ..	13·8	94
OM-A	Domestic chamber, 27° to 30° F ..	13·6	92
EG-A	Vegetable chamber, 30° to 36° F ..	13·6	93
AT-A	Ordinary hold	12·5	92

The line was obviously typical of the superior 1933 crop, and, in consequence, only slight differences were apparent between the germination capacity of the cool-storage and hold-stowed lots. Furthermore, for this shipment the lower temperatures show no significant advantages.

Experiment IV. To compare the Behaviour of Stook- and Stack-threshed Seed and the Effect of drying and shipping in Sealed Containers.

Lots of seed of the 1932 harvest, from twelve commercial lines representing six threshed from stack and six from stook, were selected and shipped to the United States Department of Agriculture at Washington in October, 1932. Six of each group were forwarded in ordinary hold storage and six dried to approximately 6 per cent. moisture content and stored in metal cans. The results are shown in Table 7 (next page).

Table 7.—Chewings Fescue (1932 Crop): Forwarded October, 1932, to Washington, United States of America.—Stook- and Stack-threshed, Dried and Undried.

Mark.	Threshed.	Transit Storage.	Germination Capacity. Initial, New Zealand.	On Arrival, United States of America.	Loss during Transit.	United States of America, after Six Months.	Total Loss after Shipment.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
TD	Stack	Hold ..	94	40	54	11	83
TR	,,	,, ..	99	57	42	34	65
EK	,,	,, ..	98	58	40	22	76
OG	,,	,, ..	94	33	61	12	82
ST	,,	,, ..	97	73	24	54	43
TD	Stack	Dried to 6 per cent and stored in metal cans	96	87	9	74	22
TR	,,		98	94	4	89	9
EK	,,		98	90	8	86	12
OG	,,		95	72	23	57	38
ST	,,		97	94	3	91	6
BW	Stook	Hold ..	95	42	53	20	75
AZ	,,	,, ..	97	57	40	25	72
AH	,,	,, ..	98	77	21	42	56
ND	,,	,, ..	97	40	57	17	80
YB	,,	,, ..	96	70	26	60	36
BW	Stook	Dried to 6 per cent and stored in metal cans	97	87	10	81	16
AZ	,,		96	90	6	93	4
AH	,,		98	95	3	93	5
ND	,,		97	85	12	75	22
YB	,,		97	94	3	95	2

NOTE.—Moisture content of composite samples on arrival: Hold, 12·3 per cent, dried, 7·33 per cent

There is no evident superiority of the stack-threshed samples, in fact, although no direct comparisons can be made, the stook-threshed lots appear to have carried more satisfactorily. It is very evident that the series included several lines of low vitality—e.g., TD, OG, BW, and ND. The results of each of these as dried and undried lots should be compared in the table. In every case, however, the dried lots gave definitely superior results.

Experiment V: To determine the Effect on Transit Deterioration of— (a) Manurial Treatment, (b) Period of Cutting, (c) Drying to approximately 5 per Cent Moisture Content, (d) drying to approximately 9 per Cent. Moisture Content, (e) Cool Storage.

The seed for this experiment was specially grown on the Department's experimental area at Gore, Southland, and up to the time of the consignment of the seed to the Seed-testing Station at Palmerston North the experiment was under the control of Mr. R. B. Tennent, then Fields Superintendent, Department of Agriculture, Dunedin, in co-operation with Mr A. W. Hudson, Crop Experimentalist, Plant Research Station, Palmerston North. Details as to the growing and harvesting of the trial plots are as follow: Seed was sown in October, 1931, at the rate of 20 lb. per acre with 2 cwt. superphosphate. The resultant sward was top-dressed in September, 1932, at following rates: I, no manure; II, superphosphate 2 cwt. per acre; III, superphosphate 2 cwt. plus sulphate of ammonia 2 cwt per acre; IV, superphosphate 2 cwt. plus sulphate of ammonia 2 cwt. plus 30 per cent. potash 2 cwt. per acre; V, sulphate of ammonia 2 cwt. per acre. The crop harvested in 1933 in three stages: (1) At barely ripe stage, 12th January, 1933; (2) at ripe stage, 16th January, 1933—seed shedding slightly; (3) at overripe stage, 18th January, 1933—seed shedding freely.

The crop was a heavy one and returned a high yield—a general average of 1,346·3 lb. per acre off the mill. Sufficient of the seed was available to allow of division into 5 lb. working-samples after dressing, which was carried out by the Station's "Clipper" cleaner.

The seed as shipped consisted of four series each of fifteen samples in groups of five representing as units first, second, and third cuts and a complete manurial series of five treatments. Series Bx represents seed dried to 5 per cent., but with available facilities it was found impossible to prevent the overdrying of some lots and the taking-up of moisture by others These remarks apply also to the Cx series planned to be dried to 9 per cent moisture content. These inconsistencies, however, apparently have not affected results. Series Bx and Cx were packed in two separate lined sacks. Series As represents undried samples forwarded in cool storage; and series Ax undried controls under ordinary hold conditions. Results are presented in Table 8. The seed was shipped in October, 1933, via the Australian Coast and the East Coast of the United States of America to Cambridge, England.

Table 8.—Chewings Fescue (1933 Crop): Trial Shipments to the Official Seed-testing Station, Cambridge, England. Shipped October, 1933 Received in England 20th January, 1934.

No.		Production.		New Zealand at Shipment.		England, on Arrival.		New Zealand, Storage Control.		Germination Loss during Transit.
		Manurial Treatment	Stage of Cutting	Moisture Content.	Germination.	Moisture Content.	Germination	Moisture Content	Germination.	
				Per Cent.	Per Cent.	Per Cent.	Per Cent	Per Cent	Per Cent	Per Cent.
Bx	1	I	First	5·8	93	8·8	94	7·8	93	0
	2	II	,,	6·9	93	8·7	94	8·1	92	0
	3	III	,,	8·2	94	9·4	94	8·2	93	0
	4	IV	,,	7·9	92	9·1	95	8·0	93	0
	5	V	,,	7·2	92	9·6	92	7·8	92	0
	6	I	Second	7·4	95	8·9	98	8·4	94	0
	7	II	,,	4·6	95	8·9	97	7·5	95	0
	8	III	,,	4·8	95	8·9	96	7·2	90	0
	9	IV	,,	5·2	94	9·1	94	8·1	96	0
	10	V	,,	4·2	94	8·6	95	7·2	96	0
	11	I	Third	3·3	92	8·8	94	7·2	93	0
	12	II	,,	4·0	94	8·4	97	7·3	94	0
	13	III	,,	3·8	94	9·5	98	7·6	96	0
	14	IV	,,	3·7	95	9·5	96	7·6	96	0
	15	V	,,	3·9	96	10·0	97	7·4	98	0
Cx	1	I	First	7·9	93	11·8	91	9·8	93	2
	2	II	,,	8·1	93	11·5	90	9·9	93	3
	3	III	,,	8·1	94	11·7	93	10·0	96	0
	4	IV	,,	7·8	94	11·4	93	9·9	93	1
	5	V	,,	8·5	92	11·4	93	9·9	92	0
	6	I	Second	6·5	95	11·0	93	9·3	97	2
	7	II	,,	10·3	95	11·4	94	10·6	96	1
	8	III	,,	10·9	93	11·7	93	10·9	95	0
	9	IV	,,	9·6	94	11·4	94	10·1	96	0
	10	V	,,	10·0	96	11·8	95	10·2	97	1
	11	I	Third	10·3	94	11·4	96	10·5	94	0
	12	II	,,	10·4	96	11·7	95	10·4	94	1
	13	III	,,	9·8	95	11·5	93	9·9	96	2
	14	IV	,,	9·6	95	11·7	94	10·1	95	1
	15	V	,,	10·2	95	11·8	96	10·3	94	0
As	1	I	First	14·0	93	14·4	80	11·3	93	13
	2	II	,,	14·1	94	14·2	80	11·7	90	14
	3	III	,,	14·0	94	14·4	82	12·1	90	12
	4	IV	,,	14·0	91	14·3	80	11·8	93	11
	5	V	,,	14·0	92	14·3	80	11·7	93	12

Table 8—continued.

No	Production.		New Zealand at Shipment.		England, on Arrival.		New Zealand, Storage Control.		Germination Loss during Transit.
	Manurial Treatment.	Stage of Cutting.	Moisture Content.	Germination.	Moisture Content.	Germination.	Moisture Content.	Germination.	
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
As 6	I	Second	14·1	93	14·2	84	12·2	94	9
7	II	,,	14·5	95	14·9	86	11·5	94	9
8	III	,,	14·1	93	14·9	88	11·6	95	5
9	IV	,,	14·1	94	14·3	87	11·8	95	7
10	V	,,	14·1	94	14·4	90	12·0	94	4
11	I	Third	14·1	93	14·2	91	12·4	95	2
12	II	,,	14·2	94	14·2	92	12·5	96	2
13	III	,,	14·2	94	14·5	90	12·1	94	4
14	IV	,,	14·5	95	14·2	93	11·8	98	2
15	V	,,	14·1	95	14·8	91	12·7	95	4
Ax 1	I	First	14·0	93	13·4	83	11·3	93	10
2	II	,,	14·1	94	13·5	80	11·7	90	14
3	III	,,	14·0	94	13·5	83	12·1	90	11
4	IV	,,	14·0	92	13·4	87	11·8	93	5
5	V	,,	14·0	93	13·2	84	11·7	93	9
6	I	Second	14·1	93	13·4	86	12·2	94	7
7	II	,,	14·5	95	13·7	88	11·5	94	7
8	III	,,	14·1	94	13·5	87	11·6	95	7
9	IV	,,	14·1	95	13·5	88	11·8	95	7
10	V	,,	14·1	94	13·6	92	12·0	94	2
11	I	Third	14·1	94	14·1	92	12·4	95	2
12	II	,,	14·2	93	13·9	91	12·5	96	2
13	III	,,	14·2	94	14·0	91	12·1	94	3
14	IV	,,	14·5	95	13·5	94	11·8	98	1
15	V	,,	14·1	95	13·7	94	12·7	95	1

Viewed merely as a shipment of seed, this experiment was undoubtedly successful, but notwithstanding the prolonged shipment on a usually unfavourable route only slight deterioration in the controls occurred. This was due not only to the fact that the seed was harvested in an unusually favourable season, but also to the fact that the seed was grown on land of a much higher fertility than the average " fescue country," and in consequence all lots, irrespective of production technique, were of a very high vitality. However, the seed has not yet completed the six months' period of storage, and one is hopeful that vitality of the controls at least will have become lowered

A review of the data as tabulated indicates that of the four series Ax (6 per cent. moisture content) shows no transit losses, that the losses for Cx (9 per cent. moisture content) are scarcely significant, that for As (cool storage) deterioration is apparent, and for Ax deterioration is approximately equal to that for As Manurial treatment does not appear to have affected results. On the other hand, the deleterious effect of early cutting is observable in series As and Ax (Numbers 1–5), the second and third cuts giving progressively superior results These differences will probably become more evident following storage.

A point of interest is the evening-up of the moisture content in Bx from a range of 3·7 per cent. to 8 per cent. to a level of approximately 9·5 per cent., and in Cx from a range of 6·5 per cent. to 10·9 per cent. to a level of approximately 11·5 per cent. A certain amount of moisture would be taken up during packing, and after sealing the available moisture has been absorbed proportionally to a consistent level. As the linings were quite moisture-proof, one can but assume that the moisture-content percentage as shown by Cambridge are those pertaining during transit, especially as those for the New Zealand controls are approximately equal.

As stated, further tests after a period of storage will be made at Cambridge, and on receipt of these results this experiment will be further reviewed.

DISCUSSION.

From the evidence presented herein it will be concluded that seed-drying offers the most satisfactory means of overcoming transit deterioration and that seed so treated will retain vitality for at least six months after delivery. Perfectly dry seed will store for a very long period: there is at the moment under test at this Station a sample of ten-year-old Chewings fescue seed which shows a growth of 75 per cent. This has been stored in a desiccator over calcium chloride and for seven years germinated over 90 per cent. The undried portion of the sample had completely lost vitality in two years and a half.

Seed-drying as carried out in various parts of the world, principally with grain, consists in the removal of excess moisture and is known as "conditioning." The grain is then stored at or near its normal moisture content. The drying of fescue, however, consists of the removal of approximately half the normal moisture content, and obviously if the seed is stored under average atmospheric conditions moisture will be taken up until the normal level is attained. It is this fact which is responsible for the difficulties which attend to the shipping of dried seed. It is not sufficient that the seed be dried, but that it be kept dry for the period of shipment and storage. Reference to Table 3 shows that dried seed in ordinary sacks shipped only to a slight extent more satisfactorily than undried, so that under these circumstances drying alone is not economically sound. The question, therefore, centres on suitable moisture-proof containers, which would conveniently be in the form of sack linings. For experiments Nos. 1 and 5 rubberized cloth linings were ordered to specification and used with success, but the cost would be prohibitive for use with ordinary commercial shipments. A number of proprietary sack linings were imported, but none were found to be sufficiently proofed to prevent the ingress of moisture. It is considered, however, that as these types of linings are designed for the storage of normally dry products — that is, as a protection against excessive moisture—the manufacturers possibly would consider the preparation of special linings for seed. The writer is at present in communication with certain firms with this end in view. There are other types of containers in which seed might be stored, but sack storage offers many advantages, the chief of which is economy and convenience. Probably the only disadvantage is the possibility of the too free use of hooks during handling in and out of store, rail, and ship.

The experimental drying was carried out in cabinet dryers heated by gas, but this type of apparatus would be quite unsuitable for bulk lines, which would require to be fed automatically and delivered into the containers and sealed while warm. In North America and in Europe there are in use a number of grain-dryers which mostly utilize heated air as the drying agent and which could be adopted for the drying of grass-seed. The rapidity of the removal of moisture depends, of course, not only on the temperature but also on the volume of air which can be passed, preferably, through layers of seed. The air may be heated by means of steam coils, electrically heated coils, coke, coal, or oil furnaces.

Nothing can be said here as to the cost of artificial drying, which must necessarily add to the export price of the seed. Presumably, however, seed of a guaranteed germination capacity would be sold at a premium. Furthermore, there are the losses in weight occasioned by the removal of a portion of the contained water, which, when the seed is in the undried state, costs money. Therefore, a minimum amount of moisture would be removed, say, 5 per cent. to 6 per cent.

The available information in respect of cool storage is not extensive, but it is evident that it offers possibilities. Artificial drying with special packing as a safeguard against deterioration during transit and storage is definitely superior, but should this method prove uneconomic or for any other reason inoperative, then cool storage provides a second line of defence. It would seem that there are possibilities in its employment for early shipments of seed intended for early sowing. It is intended to institute experiments designed to elucidate this point and also ones in regard to the most suitable storage temperatures.

CONCLUSION.

This work, necessarily limited by facilities, has been brought to the point of demonstrating the causes of deterioration not only in Chewings fescue, but also in other grass-seeds, and of showing that it is possible to overcome severe losses in viability. The work is being continued as before on a trial scale, the result of which can be used only as a basis for the treatment and storage of bulk commercial shipments. Attention here will be concentrated on the question of suitable sack linings and further drying experiments, it being the writer's contention that the future of the Chewings fescue export trade is dependent mainly upon seed-drying.

It is true that the success of laboratory results is not always so evident in commercial practice, and for this reason large-scale drying should not be attempted until trials have been made using a small-scale automatic dryer. The matter is plainly now one for the industry itself, and it is the writer's opinion that exporters and growers should co-operate in providing an experimental drying-plant. A certain amount of data concerning drying, storage, &c., has been accumulated, and will be available.

ACKNOWLEDGMENTS.

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POTATO TRIAL AT PALMERSTON NORTH, 1933-34.

A REPORT ON THE GROWING OF FORTY-EIGHT LINES OF COMMERCIAL SEED POTATOES.

J. H. CLARIDGE, Assistant in Agronomy, Plant Research Station, Palmerston North

IN 1933 the Fields Division undertook the trial of a number of samples of commercial seed potatoes, with the object of determining the variations which exist between different lines of seed. This step was taken as a result of complaints having been received in regard to the table quality of certain potatoes grown in the North Island,

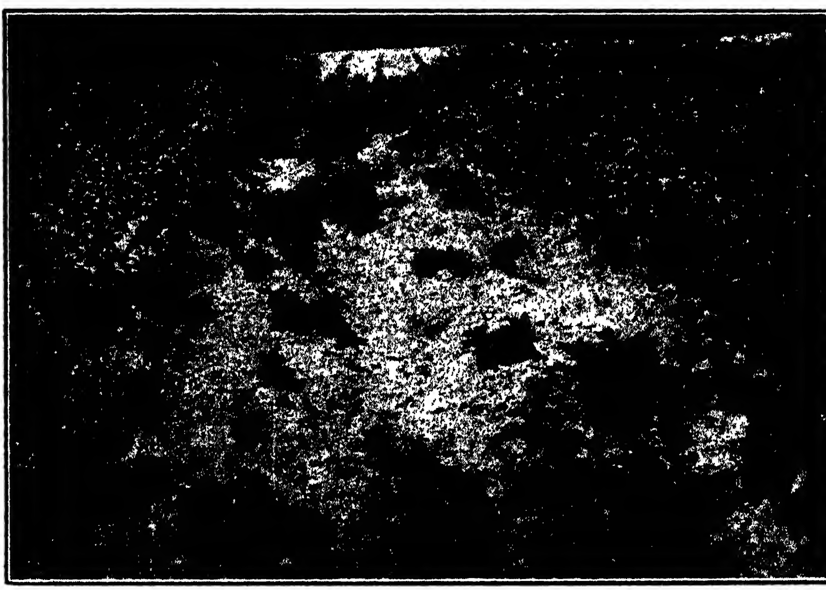

FIG 1. PLOTS OF SOME OF THE COMMERCIAL SAMPLES RECEIVED FROM GROWERS UNDER THE NAME OF IRON DUKE.

On the left a moderately vigorous line, which was identified as Northern Star. In the centre another line identified as Northern Star, but so badly diseased as to be worthless. On the right is quite a good line of the Iron Duke variety.

There was little to differentiate these samples when being planted.

particularly in relation to the physiological condition known generally as brown fleck. The trial was conducted at the Plant Research Station (Palmerston North), and growers in the Wellington Province were invited to submit samples (seventy-five tubers) of their commercial seed.

As a result forty-eight samples were forwarded for trial. Of these, six samples represented seed which had been produced in the South Island in 1932-33. In addition, four lines of certified seed were obtained by the Department itself from the South Island; these were

used for control purposes. Actually, therefore, ten out of fifty-two samples tried out were South Island grown (nine of them being the produce of certified crops). Thus, although the trial was primarily confined to potatoes grown in the Wellington District, the results have a bearing on potato-growing over the whole of the North Island and parts of the South Island.

The purposes of the trial were twofold: firstly it was an investigation into the incidence of brown fleck condition in relation to variety, while a secondary purpose was to compare the relationship between the percentage of virus infection present and the yields obtained in the trials.

The samples received were divided into two lots—fifty tubers were planted in two rows each of twenty-five tubers, while the remaining twenty-five tubers were cut and examined at time of planting for any sign of flesh discoloration. Notes were made during the season on such points as varietal purity and virus infection. When mature, the tubers were dug and weighed, two from each plant being cut and examined for flesh discoloration.

The results are given in the following table:—

Table of Results.

Row No.	Percentage of Brown Fleck in Tubers.		Percentages of			Yield in Tons per Acre.	Comments.
	Planted.	Dug.	Misses.	Foreign Varieties.	Diseased Plants.		
				AUCKLANDER SHORT TOP.			
101	..	..	..	..	4	14 0	Once grown from certified seed.
45, 46	None cut	..	2	..	10	13 9	Control—South Island certified seed.
43, 44	..	.	..	..	6	13 5	South Island certified seed planted.
29, 30	None cut	..	..	..	.	12·9	Control—South Island certified seed.
39, 40	..	..	2	..	20	12 3	South Island certified seed planted.
27, 28	..	.	..	..	8	12·2	Once grown from certified seed.
35, 36	..	..	..	2	4	12·1	Once grown from certified seed.
51, 52	..	..	..	4	8	10·7	Uncertified seed.
21, 22	..	.	..		20	10·1	Twice grown from certified seed.
25, 26	..	2	4	4	12	10 0	Once grown from certified seed.
41, 42	..	..	2	8	2	9·9	Uncertified seed (ex South Island four years)
37, 38	..	2	4	..	12	9·9	Once grown from certified seed—original line rejected in following season.
49, 50	4	2	16		4	8 6	Three times grown from certified seed.
23, 24	..	..	14	8	22	6 5	Three times grown from certified seed.
33, 34	..	..	28	..	16	5 0	Uncertified seed (low yield due in part to tubers in poor condition when planted).
				MIXED LINES (ENTERED AS AUCKLANDER SHORT TOP).			
47, 48	24	33	14	Mixed	14	9·8	Origin unknown.
31, 32	8	None cut	18	36	24	5·3	Supposed to be once grown from certified seed: first season grower has had line.
				AUCKLANDER TALL TOP.			
55, 56	1 in 5 tubers	4	..	..	2	16·3	Control—South Island certified seed. May be some "outside row" effect increasing yield.
57, 58	4	6	..	..	6	14·9	South Island certified seed planted.
53, 54	24	38	..	..	4	14·2	South Island certified seed planted.
59, 60	40	14	16	..	62	6·7	Uncertified seed.

Table of Results—continued.

Row No.	Percentage of Brown Fleck in Tubers. Planted.	Dug.	Percentages of Misses.	Foreign Varieties.	Diseased Plants.	Yield in Tons per Acre.	Comments.
				IRON DUKE.			
71, 90	None cut	12	.	..	16	15·4	Control—South Island certified seed.
72, 73	4	5	6	2	28	11·0	Three times grown from certified seed
84, 85	..	2	.	..	36	10·4	Origin unknown; entered as Aberbrothok.
93, 94	20	8	8	.	28	9·8	Three times grown from certified seed; entered as Aberbrothok
86, 87	.		2		28	9·1	Three times grown from certified seed
99 ..	None cut	4	4		48	6·7	Not certified, entered as Aberbrothok.
65, 66	32	None cut	16	..	84	0·3	Not certified.
				NORTHERN STAR.			
78, 79	28	21		.	18	13·5	Not certified, entered as Iron Duke
95, 96	16	16			24	12·9	Not certified; entered as Aberbrothok
80, 81	4	12	2	8	34	11·9	Not certified, entered as Aberbrothok
76, 77	4	7	2	8	48	9·6	Not certified, entered as Iron Duke
17, 18	4	18			52	9·3	Not certified; entered as Gamekeeper
67, 68	56	20		2	42	8·3	Not certified, entered as Iron Duke.
74, 75	32	23	18	6	42	7·3	Not certified, entered as Aberbrothok.
19, 20	None cut	22		.	58	4·7	Not certified, entered as Unknown
97, 98	32	8	6	8	72	4·6	Not certified; entered as Iron Duke
63, 64	12	24	12	2	62	2·8	Not certified; entered as Aberbrothok.
91, 92	20	8	20	8	62	2·8	Not certified entered as Aberbrothok
82, 83	24	15	38	..	72	1·3	Not certified, entered as Aberbrothok
				MIXED LINES (ENTERED AS IRON DUKE OR ABERBROTHOK).			
88, 89	4	13	2	Mixed	30	10·1	Mixed Northern Star, New Era, and Iron Duke
69, 70	16	12	16	Mixed	46	6·4	Mixed Northern Star and New Era.
				NEW ERA.			
102, 103	40	18	2	18	4	14·2	Not certified, rogues are Northern Star.
15, 16	Not cut	45	18	6	34	5·4	Not certified, rogues are Northern Star.
13, 14	8	45	30	16	44	4·5	Not certified, rogues are Northern Star
				DAKOTA			
7, 8	8	..	.	..	26	15·0	South Island certified seed planted
5, 6 ..	12	..	.	.	30	14·3	South Island (uncertified) seed planted
100 ..	..	..	..	..	4	11·3	Once grown from certified seed Yield of this line upset by premature removal of tubers.
				KERR'S PINK.			
1, 2 ..	16	9	2	16	58	10·1	Three times grown from certified seed May be some increase in yield due to "outside-row" effect.
3, 4 ..	6	8	4	..	70	6·2	Three times grown from certified seed
				GREAT SCOT.			
11, 12	..	10	..	..	82	5·6	Three times grown from certified seed.
9, 10	8	10	6	..	66	5·3	Three times grown from certified seed.

Brown Fleck Investigation.

The facts emerging from the trial in relation to brown fleck are :—

1. There proved to be correlation between the proportion of brown fleck present in the tubers planted and in the tubers dug. This is amply demonstrated from a reference to the relative columns in the accompanying table.

2. The district of origin of the seed of any one variety had no influence on the incidence of brown fleck either in that seed or in the produce grown from such seed. No comment on this fact is required other than to draw attention to the information supplied in the table.

3. There was considerable variation in the incidence of brown fleck between one variety and another.

Of the varieties under trial, Aucklander Short Top showed itself to be relatively very free from brown fleck. Two lines, entered as Aucklander Short Top, and showing a comparatively high percentage of brown fleck condition, were discovered not to be pure Aucklander Short Top, but to be mixed with some other variety.

The Aucklander Tall Top showed considerable range in the incidence of brown fleck. One of the South-Island-grown lines of this variety was equally as badly affected as the North-Island-grown line.

Of eighteen lines entered under the name of Iron Duke (or Aberbrothok, as it has been commonly known in the Manawatu district) only six samples could be considered as being true to name. Two samples were very mixed, and the ten remaining samples were practically pure lines of the Northern Star variety. While neither of these varieties was by any means as free from brown fleck as was Aucklander Short Top, the affection in the lines of Northern Star was appreciably greater than in those of Iron Duke.

The Iron Duke variety has gained the reputation of being prone to brown fleck. From the results of this trial it would appear that this reputation has been due in no small part to the fact that so many lines of potatoes sold under this name have been in reality Northern Star, or mixtures comprising Northern Star, Iron Duke, and other varieties such as New Era.

Of the other varieties under trial the highest degree of affection appeared to be in New Era, while the samples of Dakota under test were relatively free from brown fleck.

Virus Infection and Yield.

Although this trial was not laid down with a view to determining accurately any small differences in either virus infection or yield, nevertheless the differences recorded have been so great as to fully justify their use in making comparisons. Readers should keep in mind, however, that small differences may be due to experimental error.

Several points of importance arise from an examination of the information obtained from this section of the trial.

The high correlation between the "disease count" and the yield per acre of the various lines is of great practical significance. In almost every instance an increase in the number of virus-diseased plants in a line is accompanied by a reduction in yield. This confirms previous trials undertaken of a similar nature.

An examination of the origin of the forty-eight lines under trial reveals that twenty-two of these can be traced back definitely to certified seed and twenty-three lines can be traced back to uncertified seed. The origin of three lines has not been determined. It will be noticed that in general those lines of certified origin have given the best yields. In addition, those lines furthest removed from certification are in general lower in yield than those which originated from seed certified in either the 1931–32 or 1932–33 season.

Thus in Aucklander Short Top the seven best lines (including the controls) are not more than once removed from certified seed. Of the

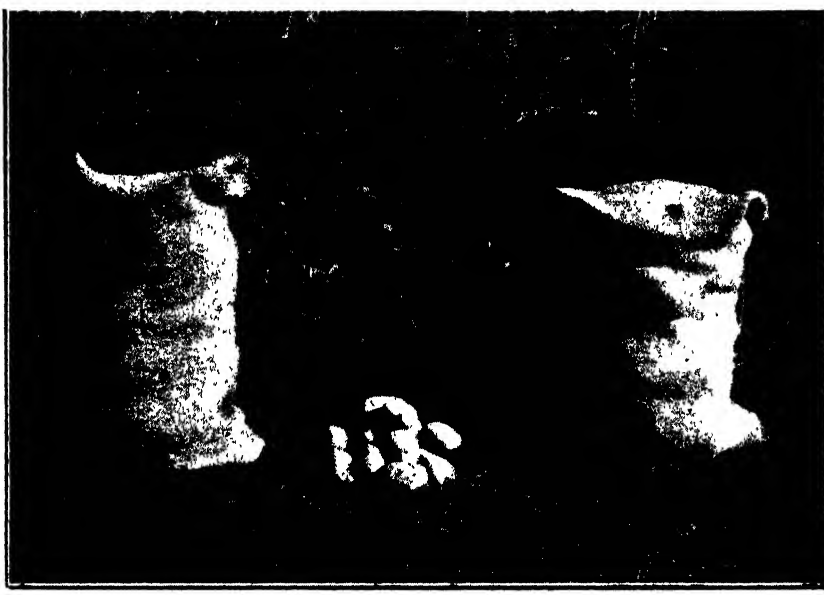

FIG 2. THE PRODUCE FROM THE THREE PLOTS SHOWN ABOVE.

Left: 11·9 tons per acre. Centre: 1·3 tons per acre Right: 10·4 tons per acre.

The crop on the left, forwarded as Iron Duke, is actually Northern Star, and while satisfactory in respect to yield is lacking in quality because of brown fleck

eight poorest lines, on the other hand, three originated from uncertified seed, two are three times removed from certified, one is twice removed, and two are once removed.

Support to the above remarks is given by an analysis of all the yields obtained, as given in the following table :—

Lines planted with—	Tons per Acre.
Certified seed averaged	14·3
Seed once grown from certified seed averaged..	11·6
Seed twice grown from certified seed averaged..	10·1
Seed three times grown from certified seed averaged	8·0
Uncertified seed averaged	7·6

The amount of deterioration exhibited more particularly in the lines of Kerr's Pink and Great Scot, which have been three times grown in the North Island from certified seed, is further evidence in support of the gradual degeneration due to the spread of virus disease which is likely to occur when conditions are suitable.

From the foregoing evidence one is justified in assuming that, in the lines under trial, a general deterioration is taking place, due to growing for a few seasons in the Wellington District. Growers in this district in particular, and in the North Island in general, would therefore be well advised to purchase certified seed from the South Island at frequent intervals

It will be noticed from the table of results that in a number of cases the low yield would appear to be due to the high percentage of misses recorded. In computing yields no allowance has been made for tubers that did not grow. All lines received similar treatment, and it was considered that any line producing a high percentage of misses did not have the same "seed" value as one in which all the tubers planted produced shaws.

Conclusions.

1. Certain varieties appear to be more susceptible than others to the brown fleck condition, whereas the district in which the tubers were grown did not, from the evidence available, appear to have any influence on the degree of infection.

2. Correlation between virus disease and yield of tubers is shown.

3. The benefits derived from the use of certified seed are illustrated.

4. Many lines of potatoes being sold under the name of Iron Duke (Aberbrothok) are either of another variety altogether, or are badly mixed.

General.

The value of the use of certified seed is emphasized by the results of this trial. Some growers have purchased seed purported to be certified and have obtained discouraging results. Purchasers are reminded, therefore, that an official tag, attached to the sack, accompanies all lines of Government certified seed.

The co-operation of those supplying samples, and of the officers of the Fields Division who arranged for the collection of these, is acknowledged.

The Minister of Agriculture has appointed Mr. Albert Smith to be a member of the New Zealand Wool Committee, *vice* Mr. H. T. Milnes, resigned.

The Minister of Internal Affairs has announced that it has been decided that in future the first Wednesday in August each year shall be observed as Arbor day, and local bodies are requested to observe 1st August as Arbor Day this year.

The Instructor in Agriculture, Auckland, reports a labour-saving method in making the open drain connecting up mole drains. The drain-plough is drawn across the end of the mole drains twice, making two cuts as deeply as possible, the width apart that the drain is to be wide. The labour of digging the drain is thereby considerably lessened.

THE MISUSE OF LIME, WITH SPECIAL REFERENCE TO BUSH-SICK LANDS.

B. C. ASTON, Chief Chemist, Department of Agriculture

THE most important effect of lime on soils is the lightening influence possessed by both ground limestone and caustic lime (quick and slaked lime) on heavy lands such as clays and some loams. Liming renders such a soil more easy to work; in fact, without previous liming it is an economic impossibility to cultivate some soils. The application of as much as 2 tons of quicklime has in the past been necessary to enable some tenacious clays to be worked in the South Island. This amount of lime may be computed as roughly equal to 4 or 5 tons of carbonate of lime (ground limestone).

In the North Island many of the loams are light, but respond well to a few hundredweight of ground limestone per acre applied in conjunction with phosphates as a pasture top-dressing. The function of lime here is to keep phosphate in an available condition for plant growth, to correct soil sourness (acidity), and to so improve the soil as a medium for crop or pasture growth that by competition the desired plants are stimulated to crowd out the unwanted weeds of low feeding-value such as sorrel and also to render the soil sweeter and therefore unfavourable for the growth of fungoid pests which attack crops, such as "finger and toe" or "clubroot." Lime also makes available certain reserves of plant-food which may be contained in either the organic (combustible) or the inorganic (incombustible) portion of the soil.

Another effect of lime is to make the pastures more suitable for cattle grazing by increasing the amount of clovers present. Plants of the family to which the clovers belong, the *Leguminosæ*, contain much more calcium than the grasses, the clovers containing up to 3 per cent. and lucerne up to 5 per cent. of lime, whereas the grasses contain less than 1 per cent. Lime therefore increases the calcium content of the pasture by increasing the proportion of clovers in it. Phosphates also have the same effect, but sometimes the combination of lime with phosphate is highly desirable to obtain the greatest response. It is important to bear in mind the general reasons for using lime in order to decide whether lime is, or under what condition it may be, useful as a dressing for bush-sick soils.

One of the most interesting and unexpected results in the early field experiments undertaken with a view to determining the effect of various top-dressings in mitigating or preventing bush sickness in ruminant stock was that lime applied either as carbonate or hydrate (slaked lime) to pasture had the effect of hastening the onset of the malnutrition symptoms in both sheep and cattle when compared with control animals on adjacent paddocks which had had no lime treatment. This experience has been repeated on every occasion where, under departmental control, lime has been used as a dressing for pasture. In addition to these official results, other farmers have observed the same ill result of top-dressing pasture with lime in even slightly bush-sick districts.

It may be also stated that at Mamaku farm no response in quantity or quality of pasture could be observed when strips of pasture were top-dressed with carbonate of lime at different rates per acre and compared with adjacent pasture on which no lime had been used, the quantities of lime used ranging from 1 to 4 tons per acre. The same lack of response to lime was also observed at Lichfield, on land very slightly bush-sick, and at Kaharoa, the most bush-sick of all lands. The soils upon which these results were obtained were technically pumiceous sandy silts or of even coarser texture, the particles in most cases being composed of air-borne pumice Laboratory tests showed that, judging by the Hutchinson and McLennan and pH methods, the soil should have responded to lime, the lime requirement method showing 0·3 and 0·4 per cent., or, roughly, from 3 tons per acre of carbonate of lime absorbable, and the pH figure 5·5 indicating an amount of acidity or sourness which would warrant the soil chemist in advising the farmer to use lime for any but acid-tolerating plants such as potatoes and oats *if the soil was a normal one.* It was, however, very early recognized that pumice soils are highly abnormal in texture and composition and therefore should not be judged by methods of analysis and other laboratory tests which are applied to ordinary soils until these tests are confirmed by field experiments. Empirical laboratory methods for determining the lime requirement of coarse pumice soils were therefore early discarded as giving misleading results. It is obvious that there can be little advantage in applying lime to a soil which grows such abundance of clover, containing up to 3 per cent. of lime in the dry matter, and therefore indicating that the plant is able to absorb lime in quantity from the soil, and further indicating that it is present in the pasture in sufficient amount for stock. That there is no serious shortage of lime in the natural food of the animals of coarse pumice lands is also shown by the excellent development of the bones of an animal at all stages of its life, even when dying of bush sickness. Neither does it appear that ground limestone would do much to improve the mechanical state of such a soil. In pumice soils there is generally no great amount of "clubroot" or "finger and toe" in cruciferous crops, indicating that the soil as a medium for healthy growth of these crops does not require sweetening although an alkaline reaction is highly beneficial for turnip production. The only argument that can be advanced for the use of lime on pastures is that possibly more carbonate of lime in the soil might enable phosphate to be retained in an available state for a longer period than would be possible without such lime, but increased susceptibility of the animals to bush sickness is rather a high price to pay for such a theoretical objective. One of the great uses of lime is, of course, to lighten heavy soils and render them easy to work, but pumice soils are already too light in texture and suffer from a deficiency of colloidal mineral matter so that this argument for the use of lime cannot be applied to pumice soils. Moreover, in light sandy lands lime is known to induce chlorosis* in plants while the animals pastured on these plants

*** For the purpose of this article it may be briefly explained that chlorosis is a condition which results in an unhealthy paleness in plants and animals.**

suffer from progressive anæmia, possibly to be explained by the fact that in soils of very open texture lime has a prejudicial effect in decreasing the availability of the soil iron or upsetting the proper balance with other elements present.

Some interesting cases have, of recent years, come to light which confirm the opinion that lime carbonate is highly prejudicial on sandy soils either to the plants growing thereon or to the stock grazed on the plants. C. G. Dickinson, B.V.Sc., Veterinary Officer to the Tasmanian Government, stationed at Ulverston, Tasmania, wrote* in 1924 concerning a malnutrition disease, similar to bush sickness, known as "coastiness" occurring on King Island off the coast of Tasmania. The soil upon which the cattle became "coasty," analysed by Mr. H. J. Colbourn, Agricultural Chemist to the Tasmanian Government, contained 30 per cent. of carbonate of lime, the other constituents being described as follows: Phosphoric acid low, but sufficient to meet purpose of moderate crop, nitrogen abundant, potash fair. The chemist was inclined to think that the morbid condition of the stock was brought about by the very large quantity of carbonate of lime present. On the land at King Island where stock remained continuously healthy the soil also contained a large amount of organic matter, but the phosphoric acid and potash were not greatly different in amount from the unhealthy or "unsound" land. The carbonate of lime was, however, greatly less in quantity, being only 0·4 per cent. It must also be stressed that the unhealthy soil contained less than 2 per cent. clay, whereas the healthy soil contained 23 per cent. Other nearby sandy soils are described as containing less than 0·3 per cent. of carbonate of lime and from 8 to 18 per cent. clay, which are described as "semisound" or "sound." It certainly looks as if the lime here had a deleterious effect in conjunction with the sandy nature of the soil on the stock grazed on that area.

From the Veterinarian's report it would appear that the King Island malnutrition is probably the same as bush sickness in New Zealand since in both places (1) the prominent symptom is progressive anæmia; (2) the cattle can be cured by transferring to "sound" land; (3) the cattle show signs of the disease after being on unsound land for some months; (4) the cattle recover when put on to sound land, but do not increase in condition until put back on to unsound land. This is particularly the case with "coastiness," the cattle being changed about periodically until they are finally put on to the luxuriant growth on unsound land to fatten; (5) cattle on unsound land fed on fodder grown on sound land resist the disease for a very much longer period than otherwise they would do; (6) iron treatment of calves is efficacious in warding off the malnutrition in both diseases. It is to be observed that the soil of the unsound land is a grey sand, but that of the sound land is an ironstone gravel.

Almost at the antipodes of Tasmania another similar instance of a malnutrition disease in cattle and sheep was published in 1933 by Grigg and Dryerre (*Vet. Jour.*, 89, pp. 99–110). The conditions seem to be very similar to those occurring on King Island, Tasmania. The trouble is called "pine" in Scotland, and on one of the Inner Hebrides, Tiree, an island of some 34 square miles in area, the surface of

* Personal communication. (See also *Australian Veterinary Journal.*)

which consists of blown sands, rock, and raised beach, on the blown sands, which contain 50 to 60 per cent. of calcium carbonate in the form of broken sea-shells, " pine " develops, but is curable by changing the stock to the raised-beach type of soil, which contains lime equal to only 2.4 per cent. carbonate of lime and more than twice the amount of iron oxide that the blown sand contains. There does not appear to be a great difference in texture between the blown sand and the raised-beach types. The latter type is a gravelly soil or gravelly sand. The individual grains are often rust-stained and irregular iron-cemented layers or iron pan have been noted in some pits. The symptoms of the " pining " animals are those of the progressive debility accompanied by anæmia and emaciation and, in fact, are similar to those of bush sickness. The authors effected a cure of " pining " by dosing fourteen cattle with iron oxide and salt. Control animals having no iron became affected with " pine " malnutrition. The authors concluded that the administration of crude ferric oxide with or without the addition of dicalcic phosphate appears to be of specific curative and preventive value in " pine," and it appeared to them probable that the cause of " pine " is the deficiency of iron in the pasture and/or of " available " iron in the affected areas. " Pine," " vinquish," or " daising " also occurs in the Cheviot Hills of north Britain and as predicted by the writer in 1924 (*Transactions, New Zealand Institute*, Vol. 55, p. 723) that " pining " in Scotland, " coastiness " in King Island, " nakuruitis " in Kenya, and " bush sickness " in New Zealand would be found to have the same cause—namely, iron starvation—and in all of these cases it has been since found that the disease is curable by administration of iron licks or remedies.

In New Zealand bush sickness is not confined to the pumice sandy country whether inland or coastal, but no doubt occurs on the dune sands of the North Island sea littoral when sheep are confined to pure pasture on fixed dunes.

Having established the fact that malnutrition, of the bush-sickness type, in ruminants occurs in two widely separated stations on opposite sides of the world on sandy soils very rich in calcium carbonate—an unusual combination—it is not surprising that applications of lime on the bush-sick lands of New Zealand have not only failed to do good to pasture, but have actually done harm to stock. Unfortunately, when these experiments were initiated in New Zealand, there was no previous knowledge of anything similar anywhere else in the world from which one might derive guidance in the treatment of this remarkable New Zealand trouble in stock.

On reference to the *Journal* of this Department, it will be seen that from 1912 practically down to the present day, as a result of the experiments in the pumice lands, warnings have been issued to farmers from time to time against using lime for top-dressing pasture on coarse pumice lands. For drilling in the turnips in the seed and manure drill, on the other hand, lime has been recognized as a very useful amendment on the same lands. Thus on the 15th August, 1912, page 123, is stated, ". . . phosphates are known to have a good effect in mitigating the injurious effects of manganese compounds present in excess. Lime, it

is interesting to note, has the opposite effect*; and there is some evidence that lime has an injurious action on the feeding-quality of pasture on bush-sick lands."

On the 16th June, 1913, page 616, are recorded the results of experiments on animals grazed on paddocks differently top-dressed. Four sheep at Te Pu were put on a paddock top-dressed with quicklime, 1 ton per acre. All died in ten months. In the control paddock, however, sheep lived for a year. On a paddock top-dressed with basic slag three animals out of five died in ten months, the other two being killed by accident. At Mamaku similar results were obtained. On paddocks treated with lime alone, and lime and super, all sheep and steers were affected, the sheep all dying, while some sheep on the control paddock were not affected after two years' grazing.

On the 20th October, 1916, page 275, it was stated: "Basic slag alone,† though it produces an abundant growth of herbage, does not seem so suitable for combating bush sickness. . . ." This is probably due to the lime contained in it. Lime alone seems to do more harm than good in connection with bush sickness.

In *Transactions, New Zealand Institute*, 1924, Vol. 55, p. 720, in which an abstract on bush sickness work is published, the writer states: " . . . When bush-sick pasture is top-dressed with lime the animals become bush-sick sooner than on land which has had no treatment. This may be connected with the well-known fact that chlorosis of plants often occurs on sandy land having an excess of lime."

In the *Journal* for the 21st April, 1924, page 221, is stated: "Liming evidently has a good influence on the turnip crop, though its effect on bush-sick pasture is not apparent, and animals pastured on newly limed areas become bush-sick quicker than on untreated pasture."

In the *Journal* for the 20th June, 1924, page 386, is stated: " . . . It appears that soils which gave rise to malnutrition diseases in plants and animals are often soils of a loose texture and coarse nature, and frequently are alkaline owing to an excess of lime in the soil. It is significant that application of lime hydrate or carbonate as a top-dressing to pumice pasture lands causes ruminants pastured thereon to become bush-sick in a shorter time than they would on land not so treated.

In the "Proceedings of the Third Pan Pacific Science Congress, Tokio, 1926, page 2545, it is stated: "Applications of lime, whether as carbonates or burnt lime, cause the onset of the disease to be accelerated, and the animal dies much sooner than if pastured on untreated land."

The *Journal of Agriculture*, 20th August, 1927, page 100, states, " . . . For anything coarser than a silt it is best to keep the soil reaction acid, which inhabits the use of such alkaline dressings as are supplied by most forms of lime. There is no doubt that lime will have to be distributed on many North Island

* Kelly: "The Functions and Distribution of Manganese in Plants and Soils," Bull. 26, Hawaii Experiment Station, 1912. Also Guthrie and Cohen: *Agricultural Gazette*, New South Wales, pp. 125, 435, 1910

† Mixed with an equal part of super, slag is, however, the best fertilizer known for bush-sick lands, supplying iron to the soil in the cheapest and best form.

lands in increasing quantities in the future, but on the coarser pumice lands, it will not be good practice to apply lime for very many years; not only is lime now unnecessary but it is even harmful."

In *Transactions, New Zealand Institute*, Grimmett and Simpson, 1928, Vol. 59, page 399, state: "The series grown on the 'pining' soil offers the most interesting comparisons . . . The application of lime . . . has definitely depressed the percentage of manganese in the crop."

In the *Transactions, New Zealand Institute*, 1929, Vol. 60, page 47, it is stated: "Lime applied in amounts from 1 ton to 2 tons per acre to the pasture growing on sandy silt soils of the pumice type has given deleterious results to the stock. In fact, stock lose condition more quickly on limed land than on paddocks to which no treatment has been applied. This was confirmed by several experiments at Mamaku and Lichfield. It is a well-known fact in agricultural science that amelioration of sandy lands is better effected by the addition of organic manures than by lime."

In the *Journal of Agriculture* for February, 1932, page 109, it is stated: " . . . In the case of bush-sick pumice soils, lime at first has a deleterious effect on the stock pastured on lands recently limed . . . In field trials there is no appreciable response from the pasture. Clubroot and other troubles curable by lime are not generally present on pumice lands, although turnips are benefited by the addition of lime to the manure sown with the seed. The best fertilizer of all for both turnips and pasture is a mixture of basic slag and superphosphate."

The Quarterly Report to the Marketing Board to the 30th September, 1932, states: " . . . There have been excessive amounts of lime used on Morton Mains land and it is perhaps possible that this has caused more lime and manganese to be absorbed by the grasses than is good for the animal in its iron metabolism."

The Chief Chemist reported on visit to Rotorua, 11th October, 1922, that the treatment of bush-sick pasture with lime or limestone is not in practice found to be efficient but rather the reverse, the animals becoming bush-sick more quickly on limed pasture than on that which has received no treatment whatever. It is, however, highly probable that the liming of the turnip crop will be profitable. Better turnips were obtained on the land on which the pasture had been limed than on unlimed land, though no improvement could be noticed on the pasture, a close mat of Chewings Fescue, at Mamaku, which had been limed prior to breaking it up for turnips. In an experiment near Rotorua, a 40 ton crop of turnips was obtained by a settler of Malfroy Road, with lime sown with turnip manure and seed. An adjoining crop treated with the same seed and manure on the same kind of soil gave a very poor crop (about 8 tons).

In a memorandum to the Director of the Live-stock Division the Chief Chemist, under date of 6th December, 1922, states, *inter alia:* "On a limed paddock the stock become sick quicker than on pasture which is untreated."

(To be continued.)

HOT-WATER TREATMENT OF SEED OF BARLEY AND WHEAT.

I. CROP RESULTS WITH BARLEY IN CANTERBURY, SEASONS 1930 TO 1934.

C. H. HEWLETT and J. H. HEWLETT, M.A., Canterbury (N.Z.) Seed Co., Ltd., Christchurch, N.Z.

THE following report surveys another year's results of the work carried out by the Canterbury Seed Co., with the advice and assistance of Mr. J. C. Neill, Field Mycologist, Department of Agriculture. Below a comparison has been made between owners' seed and treated seed. The loss to the barley-grower through the practice of sowing his own seed is once more emphasized, although the number doing so has substantially decreased. Tables Nos. 1 to 2 show to what extent the quality of the crop was adversely affected.

Table 1. Grading of Product of Treated Seed, 1934. (Average of all districts.)

Quality.	Chevalier.	Spratt-Archer.	Goldthorpe-Spratt	Plumage Archer.	Total.
	Per Cent.	Per Cent	Per Cent	Per Cent	Per Cent.
No 1 Grade ..	75·8	86 0	100·0	82 3	81·0
No 2 Grade ..	18·9	12 2	..	16·4	15·9
Under grade .	5 3	1·8	.	1·3	3·1
Totals	100 0	100·0	100·0	100·0	100 0
Number of fields ..	102	59	9	52	222
Acres	1,538	856	108	827	3,329

Table 2.—Grading of Product of Owner's Seed, 1934. (Average of all districts.)

Quality.	Chevalier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer	Total.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
No 1 Grade ..	63·5	71 4	..	..	69·3
No. 2 Grade ..	36 5	28·6	..	..	30·7
Under grade ..	..	..	..	..	..
Totals	100·0	100·0	..	..	100 0
Number of fields ..	4	6	..	..	10
Acres	49	139	..	..	188

Tables Nos. 3 to 10, covering a period of five years, contain actual harvest results of "mill firsts," with a five-year average covering the whole period. The barley-grower in each district is thus supplied with detailed information both as to yield per acre and quality.

ELLESMERE.

Table 3.—Yield per Acre.

Year.	Number of Fields	Acres.	Chevalier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1930 ..	159	3,088	49·04	52·83	25·40	41·15	51·96
1931 ..	221	4,489	34·94	41·32	49·72	69·86	40·33
1932 ..	134	2,003	33·67	38·22	49·28	51·93	38·11
1933 ..	153	1,721	41·70	38·60	46·90	45·80	42·00
1934 ..	159	2,548	44·80	54·60	42·00	53·20	50·30
Totals ..	826	13,849	40·60	45·30	44·90	50·40	44·60
Number of fields	..	..	213	512	9	92	826
Acres ..	..	..	3,363	8,908	172	1,406	13,849

ELLESMERE

Table 4.—Grading of Product (No. 1 Grade).

Year.	Number of Fields	Acres.	Chevalier	Spratt-Archer	Goldthorpe-Spratt	Plumage Archer.	Total.
			Per Cent.	Per Cent	Per Cent.	Per Cent	Per Cent
1930 ..	159	3,088	95·03	79·00	100·00	100·00	81·45
1931 ..	221	4,489	39·42	49·64	100·00	100·00	48·91
1932 ..	134	2,003	45·83	52·71	100·00	83·38	54·78
1933 ..	153	1,721	47·60	24·40	Nil*	28·90	32·10
1934 ..	159	2,548	76·50	88·40	100·00	84·60	83·30
Totals ..	826	13,849	62·20	62·90	56·30	67·70	63·30
Number of fields	..	..	213	512	9	92	826
Acres ..	..	..	3,363	8,908	172	1,406	13,849

* None passed as No. 1 Grade.

DUNSANDEL.

Table 5.—Yield per Acre.

Year	Number of Fields	Acres	Chevalier.	Spratt Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1930 ..	15	368	51·69	53·50	45·83	..	52·65
1931 ..	22	469	40·26	35·75	28·16	..	35·78
1932 ..	6	116	..	24·28	..	..	24·28
1933 ..	8	122	45·50	23·80	..	54·40	39·40
1934 ..	18	313	40·40	46·80	..	52·70	45·60
Totals ..	69	1,388	42·30	40·30	38·50	53·40	41·80
Number of fields	..	..	18	42	3	6	69
Acres ..	..	..	261	936	60	131	1,388

DUNSANDEL.

Table 6.—Grading of Product (No. 1 Grade).

Year.	Number of Fields.	Acres	Chevalier.	Spratt-Archer.	Gold-thorpe-Spratt.	Plumage Archer.	Total.
			Per Cent	Per Cent.	Per Cent	Per Cent.	Per Cent.
1930 ..	15	368	100·00	80·66	100·00	..	83·61
1931 ..	22	469	87·04	26·57	Nil*	..	32·13
1932 ..	6	116	..	46·02	..	..	46·02
1933 ..	8	122	69·20	Nil*	..	100·00	64·60
1934 ..	18	313	69·20	Nil*	..	100·00	73·20
Totals ..	69	1,388	63·90	53·80	69·50	75·90	59·00
Number of fields	..	..	18	42	3	6	69
Acres ..	..	..	261	936	60	131	1,388

* None passed as No. 1 Grade.

LINCOLN

Table 7.—Yield per Acre

Year	Number of Fields.	Acres	Chevalier	Spratt-Archer	Gold-thorpe-Spratt	Plumage Archer.	Total.
			Bushels	Bushels	Bushels	Bushels	Bushels.
1930 ..	48	571	53·77	53·08	36·63	34·42	50·60
1931 ..	52	771	52·65	42·03	33·38	51·62	44·97
1932	42	365	46·45	35·56	32·63	..	39·14
1933 ..	42	361	53·50	37·40	62·60	49·20	49·30
1934 ..	55	656	53·30	60·30	40·70	49·60	52·50
Totals ..	239	2,724	52·50	44·80	39·80	46·70	47·80
Number of fields	..	..	114	85	30	10	239
Acres ..	..	..	1,202	1,078	297	147	2,724

LINCOLN

Table 8.—Grading of Product (No. 1 Grade).

Year.	Number of Fields	Acres	Chevalier	Spratt-Archer	Gold-thorpe-Spratt	Plumage Archer	Total.
			Per Cent	Per Cent.	Per Cent	Per Cent.	Per Cent.
1930 ..	48	571	81·98	71·10	100·00	100·00	78·45
1931 ..	52	771	91·21	61·95	62·19	Nil*	67·99
1932 ..	42	365	70·52	5·00	46·74	..	40·29
1933 ..	42	351	57·90	15·90	92·50	52·30	52·90
1934 ..	55	656	80·30	56·30	100·00	77·90	78·60
Totals ..	239	2,724	78·30	53·60	82·80	50·10	68·00
Number of fields	..	..	114	85	30	10	239
Acres ..	..	..	1,202	1,078	297	147	2,724

* None passed as No. 1 Grade.

SUMMARY OF DISTRICTS, 1930, 1931, 1932, 1933, 1934.

Table 9.—Yields per Acre

District.	Number of Fields	Acres.	Chevalier	Spratt-Archer.	Gold-thorpe-Spratt	Plumage Archer	Total.
			Bushels	Bushels	Bushels	Bushels	Bushels.
Ellesmere ..	826	13,849	40·60	45·30	44·90	50·40	44·60
Dunsandel ..	69	1,388	42·30	40·30	38·50	53·40	40·40
Lincoln ..	239	2,724	52·50	44·80	39·80	46·70	47·80
Totals ..	1,134	17,961	43·60	44·80	41·30	50·30	44·90
Number of fields	..	..	345	639	42	108	1,134
Acres ..	..	..	4,826	10,922	529	1,684	17,961

Table 10.—Grading of Product (No. 1 Grade).

District	Number of Fields.	Acres	Chevalier	Spratt Archer	Gold-thorpe-Spratt.	Plumage. Archer.	Total.
			Per Cent	Per Cent	Per Cent	Per Cent	Per Cent.
Ellesmere ..	826	13,849	62·20	62·90	56·30	67·70	63·30
Dunsandel ..	69	1,388	63·90	53·80	69·50	75·90	59·00
Lincoln ..	239	2,724	78·30	53·60	82·80	50·10	68·00
Totals ..	1,134	17,961	67·10	61·30	72·00	67·00	63·70
Number of fields	..	..	345	639	42	108	1,134
Acres ..	..	..	4,826	10,922	529	1,684	17,961

In considering the data greater attention should be taken of averages covering a large area over a period of years than those covering one year only. In judging varieties the ideal is one combining a high yield with a high grade of quality.

INCIDENCE OF DISEASE.

A period of very dry weather followed sowing until the 19th December; thereafter conditions were more favourable, but the quality of the grain was adversely affected by intermittent showers during harvest.

Following are summarized observations regarding the various fungous diseases—*Loose Smut:* None observed. *Covered Smut:* None observed in crops from seed either direct hot-water treated or once removed from hot-water treatment. A trace present in a few crops grown from seed in which was accidentally mixed a pure strain which had not been rendered smut-free. *Rust:* None in early crop and only one or two late crops affected. *Mildew:* None observed. *Stripe:* A few traces only.

II. CROP RESULTS WITH WHEAT.

In 1924, when the hot-water treatment of seed barley was first started here, a certain amount of seed wheat was similarly treated and sown on the Canterbury Seed Co.'s farms. Since then an increasing amount of seed wheat has been treated annually, and the product of this seed has been distributed among the wheat-growers.

In 1928 the certification of seed wheat was commenced by the Department of Agriculture and the Wheat Research Institute with the object of enabling farmers to secure strains true to name. During the past seven or eight years the above institutions have bred a number of pure strains, and many of these have been handed over to the Canterbury Seed Co. for multiplication and for hot-water treatment to free them from both loose and covered smuts.

After seed-wheat certification had been in operation for three years and a considerable area of wheat grown from certified seed, and hot-water-treated seed had been entered for certification, the Wheat Research Institute and the Department of Agriculture decided to grant certificates only to those crops which had been grown from hot-water-treated pure strains. Thereafter the only wheats to be certified were the product of seed which at some time previously had been through the hot-water treatment.

During the last few years the incidence of smut in wheat has diminished greatly, so that now it is a very small worry in the milling trade compared to conditions ruling ten or twelve years ago. Also the yield of wheat has steadily increased during this period. Although a portion of the increased yield may be due to more favourable seasons, the general increase is undoubtedly due to a combination of factors, the chief of which are the elimination of loose and covered smut by hot-water treatment, the production of pure strains by the Department of Agriculture and the Wheat Research Institute, the rejection of useless strains as a result of the Wheat Research Institute's work, and the certification of pure smut-free strains by the Department of Agriculture.

BLUE LUPINS IN CANTERBURY.

R. McGillivray, Fields Superintendent, Christchurch.

The value of annual lupins for green-manuring purposes has long been recognized, and the Department of Agriculture conducted lupin experiments in Canterbury as far back as 1911.

In these trials the white variety found much favour owing to the rapidity of its growth and the abundance of foliage available for turning under. In a trial at the Ashburton Experimental Farm in 1920 the white variety proved definitely superior to the blue in production per acre, but was found susceptible to serious frost injury, and for that reason was adjudged inferior to the blue variety (*Lupinus angustifolius*) for general sowing in frosty districts. All lupins are subject to frost injury in the early stages of growth, and for that reason late autumn sowing is not advisable.

In some quarters the opinion is held that lupins will grow only on sandy or light shingly soils, but this is not the case, as blue lupins make excellent growth on clay soils and the production on such soils is frequently far in excess of that of the free-soil types.

Growers of lupins who have not had previous experience of the crop have at times expressed keen disappointment in connection with the early growth of the lupins. Germination is generally good but

for a time growth is slow. When, however, the plants are fully established development is fairly rapid. It can be said that lupins take a long time to mature, but when sown with other crops such as rape and turnips this slowness of maturity is not detrimental as the rape and turnips grow quite well in co-operation with the lupins, which do not appear to reduce the yield of rape or turnips. There is, however, considerable difference of opinion on the point as to whether the growth of lupins in any way increases the yield of turnips or rape. The general opinion is that no great increase takes place, but one can state definitely that there does not appear to be any reduction in yield due to the dense growth of the lupins.

When sown with a pasture-mixture there is apparently considerable benefit accruing to the grasses from the lupins, as establishment, in spite of considerable shading, is good, and the grasses are of a good colour. This has been noticed even in the case of volunteer grasses growing with rape and turnip crops in which lupins have been included. The grass plants under such circumstances, even in the case of sweet vernal and dryland brown top, show a dark green, vigorous, and healthy growth. Under dry climatic conditions and in light land the inclusion of lupins when laying down a pasture has distinct possibilities.

For some years past inquiries have been coming to hand from farmers in various districts in connection with the growing of blue annual lupins for both green manuring and fodder purposes. The opinions of farmers who have grown lupins for feed purposes are extremely diverse. Some are quite satisfied with their results, while others state that none of their animals will eat the lupins. In making inquiries as to the time of feeding, farmers' views again are found to be most conflicting. Some state that they have found the greatest benefit from feeding when the growth is 4 in.; others feed when about 12 in. of growth is showing, while others again favour feeding at the flowering stage, and a number state that no feeding should take place until the pods are nearing maturity. This probably is the best time to feed.

The concensus of opinion is that at first sheep do not take kindly to lupins and eat all other feed present in the field before the lupins are dealt with. A number of farmers have reported a death-rate among their sheep and lambs through lupin-feeding, but hardly two opinions are identical as to the time that the lupins are most toxic. The symptoms of trouble seem to be trembling and a staggering gait and the trouble is greatest amongst breeding-ewes. One grower of lupins reported that he found it necessary to use great care in shifting his sheep after they had been grazing on a lupin area for a fortnight or three weeks as he found they were liable to have staggers, but he stated that he considered they could be cured by being placed on grass.

In sowing rape and lupins the seeding is approximately one bushel of lupins and 2½ lb. of rape per acre, sown through alternate coulters with a resultant crop of a drill of rape and a drill of lupins alternately throughout the field. If sown with turnips the seeding is from 8 oz. to 10 oz. turnips and from a quarter to half bushel of lupins per acre sown through alternate coulters. The oat mixture is one bushel oats and from one and a half to two bushels of lupins per acre, the seed

being mixed and sown through every coulter. For best results in germination lupins should be sown at a depth as shallow as possible.

Some farmers sow lupins without fertilizers; others use superphosphate at the rate of 1 cwt. per acre, while others favour the lime-super. mixture applied at various rates, according to the view of the various farmers.

In some cases where cereals follow a lupin crop that has matured there is a considerable volunteer growth of lupins in the cereal crop and in one district a farmer has found that the lupin seed scattered by north-west winds has secured a hold on his tussock country and under these circumstances may become a weed.

In conclusion, one can summarize the position as follows: For green-manuring purposes lupins are an excellent crop to grow. For seed-production they have generally proved a profitable crop but are somewhat difficult to harvest. Under conditions of good rainfall it is doubtful if lupin-culture is worth much consideration from a grazing point of view. Under the dry climatic conditions prevailing in Canterbury they have a value for grazing, especially in combination with other crops, and it is proposed later on to give actual particulars of results obtained by farmers who have been growing lupins for various purposes.

SEED TREATMENTS FOR WHEAT, BARLEY, AND OATS.

J. O. C NEILL, Field Mycologist, Plant Research Station, Palmerston North.

ANY cereal-grower who omits to treat his seed for the prevention of smut diseases is running a foolish and unnecessary risk. The expense and trouble of doing so is a very small premium to pay for insurance against an otherwise almost certain loss in quantity and quality of the crop.

Until comparatively recent years wet "pickles" were used for this purpose, usually solutions of bluestone or formalin. These "pickles," while holding the smuts in check fairly well, were troublesome to carry out, and frequently led to more or less severe injury to germination and early growth of the crop. The modern tendency in all countries is to substitute for them treatment of the seed by various chemicals in dust form. The chief advantages of the dusts are their greater reliability in smut control combined with complete elimination of the risk of seed injury, ease of application when a dusting machine is available, better run through the drill, elimination of risk of reinfection from sacks, &c., between treatment and sowing, and the fact that, since dusted seed keeps at least as well as untreated seed, treatment may be done at any convenient time between harvest and sowing. This latter fact allows of treatment following machine dressing, the grower receiving his seed dressed and dusted ready for sowing. Their chief disadvantages are greater cost for material (from 2d. to 4d. per bushel of seed depending on the dust used), the need for a special machine to do the dusting, and the fear of poisonous effects on the workmen who carry out the dusting. Taking these disadvantages in order: the cost *per bushel of seed* is

certainly much higher, but the extra cost *per acre of crop* is at the most under a shilling—a small sum compared with the possible loss from a poor strike or a smutty crop; secondly, dusting must be done thoroughly or not at all, and this involves the use of a dust-proof mixer—not a usual article of farm equipment. An efficient, if somewhat slow, home-made machine can be made for less than £2, and factory-made machines purchased for very little more. Further, most seed-cleaning works are now prepared to dust seed lines at a cost equivalent to labour and material. Reported failures of dust treatments to control smut can generally be traced to inefficient application—tumbling in a sack or shovelling on a floor for instance. For the third objection, no unpleasant effects are to be feared from the dusts provided reasonable precautions are taken to avoid breathing dust laden air.

METHODS RECOMMENDED IN ORDER OF PREFERENCE.

(1) ORGANIC-MERCURY DUSTS (CERESAN, AGROSAN G., ETC.).

These are applied at from 1½ oz. to 2 oz. and cost from 3½d. to 4½d. per bushel. They are excellent preventives of smut on all cereals, excepting the loose smuts of wheat and barley (which are only controlled by hot-water), and, in general, promote a quicker and more vigorous germination than that of untreated seed.

(2) COPPER CARBONATE AND COPPER OXYCHLORIDE DUSTS.

These are applied at 2 oz. and cost about 1½d. per bushel. They are efficient controllants of stinking or ball-smut in normal lines of seed-wheat, but are not effective with barley or oats. They have no adverse effect on germination.

(3) FORMALIN STEEP AND SPRINKLE.

For steeping wheat the solution should be made up at the rate of 1 pint of commercial formalin to 60 gallons of water; for barley and oats at 1 pint of formalin to 40 gallons of water. Cost of material about ¾d. per bushel.

Steeping Method.—The bags of seed, one-third full, should be dipped overnight for ten minutes in the formalin solution made up exactly to the recommended strength. Additional quantities added to the bath to keep up the level should be first made up to the same strength. After dipping, the bags are flattened out singly on a floor with good drainage to partially dry out. The seed will be ready to sow the next day. If facilities are available, it is better to empty the grain into a perforated container in the formalin bath and to skim off the smut balls, the seed being afterwards placed in a covered heap to drain. When left amongst the seed the smut-balls may break in the drill and reinfect the seed.

Sprinkle Method.—Using the same strength of formalin solution, thoroughly wet the seed by sprinkling through the fine rose nozzle of a watering-can while turning with a shovel on a barn floor. The solution should be used at the rate of 1 gallon to 4 bushels. After thorough mixing, the seed should be piled in a heap and covered overnight with sacks soaked in the formalin solution.

Seed disinfection with formalin is a good preventive of smut but may cause severe injury to germination if, for any reason, sowing is delayed or if the soil is dry and remains so for a few days after sowing.

(4) BLUESTONE STEEP OR SPRINKLE.

Strength of solution: 1 pound bluestone to 10 gallons of water; cost of material about ⅛d. per bushel. The sprinkle method as outlined for formalin is commonly employed by farmers who still pickle with bluestone. Bluestone, though it controls smut fairly well, invariably depresses germination and early growth, and for this reason cannot be recommended.

BISULPHITES AS WEEDKILLERS.

It was pointed out in a recent article (see "Chemistry of Weedkillers," by B. C. Aston and J. A. Bruce, page 173 of this *Journal* for March, 1934) that in the course of a search for a suitable chemical compound for killing ragwort, which would not have the inflammable and explosive properties of sodium chlorate, certain oxidizing salts might prove efficient in ragwort-control. In following up this line of investigation the above writers have to report that other salts, such as bisulphites which are non-inflammable and non-poisonous, in addition to hypochlorites, thiocyanates, and chromates, have so far given some promising results when used in fairly strong solutions and in the dry form, in preliminary ragwort extermination experiments.

The cost of bisulphites is in general much lower than the usual type of weedkilling compounds, being, for instance, very much cheaper to manufacture than sodium or calcium chlorate.

When tried out on lawns, gardens, and paths in Wellington in the dry and solution form good kills of weeds were obtained, a fact which is suggestive that they may yet prove, for example, to be more suitable for this particular domestic use than the decidedly poisonous arsenical preparations and the dangerous chlorate compounds which have been in use for some time.

The toxicity of bisulphites as weedkillers, and their effectiveness as ragwort exterminators in particular, will be learned from the conduct of further experiments under various conditions, and at a later stage it will be possible to report in this *Journal* more accurately their scope in this direction.

The manufacture of commercial bisulphite of soda is accomplished by passing sulphur dioxide gas through caustic soda solution, until saturation occurs, when crystals of bisulphite of soda are deposited.

—*B.C.A. and J.A.B.*

INVENTIONS OF AGRICULTURAL INTEREST.

Applications for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 31st May to 28th June, 1934, include the following of agricultural interest.—

No. 70214: Regulating flow of milk, R. M Marshall. No. 70814: Hinge; A. S. Irvine. No. 70853: Refrigerator; Imperial Chemical Industries, Ltd. No. 71136: Manure-distributor; J. Macalister. No 71836: Insect-trap; J. S. Allan. No. 71924: Vat for cream; F. C. Anderson. No. 71955: Bridle; A. E. Tilburn. No. 71982: Spraying-apparatus; G. A. Hinds. No 70476: Chicken-brooder; S. H. Bevan No. 71616: Coupling for tractor and trailer; O. D. North, P. G. Hugh, and Scammell Lorries, Ltd. No. 71807: Seed-sower; G. W. Wakeham.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION TO 30TH JUNE, 1934.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list comprises those crops passed up to 30th June. Further lists will be published in later issues.

In the June *Journal* was published a list of growers who have received provisional certificates. The acreage, percentages of foreign varieties present, and the group number and classification representating the relative merits of lines were given in that list, to which intending purchasers should refer.

AUCKLANDER SHORT TOP.

Mother Seed—

Dyer, H., Southbrook, Rangiora
Hegan, J., and Son, Southbrook, Rangiora.
Martin, W. E., R.M.D., Kaiapoi (Line B).
Oakley, W., R.M.D., Halkett
Petrie, J., jun., R.M.D., Swannanoa
Swanson, W., Selwyn.

Commercial Seed—

Berryman Bros., 88 Winter's Road, Papanui, Christchurch.
Eder, W., R.M.D., Sefton
Porter, E., St Andrews.
Seivwright, R. M., Meadows, Washdyke.
Weeber, H., Englefield Road, Belfast.

DAKOTA.

Mother Seed—

Johnston, R. H., Dunsandel.

ARRAN CHIEF.

Mother Seed—

Wright, L. T., Annat (Line A).

Commercial Seed—

Brown, A. F., 287 Withell's Road, Riccarton, Christchurch.

ARRAN BANNER.

Mother Seed—

Oakley, W., R.M.D., Halkett.

Commercial Seed—

Dyer, H., Southbrook, Rangiora.
Guy, T. A. and E. B., Yaldhurst.

KING EDWARD.

Mother Seed—

Brown, A. F., 287 Withell's Road, Riccarton, Christchurch.

KING EDWARD—*continued.*

Commercial Seed—

Craig, G. H., Factory Road, Mosgiel.

JERSEY BENNES.

Mother Seed—

Wilson Bros., Quarantine Island, Port Chalmers.

Commercial Seed—

Graham, J. W., Factory Road, Mosgiel

EARLY REGENT BOLTER.

Mother Seed—

Oakley, W., R.M.D., Halkett.

Commercial Seed—

Oakley, J. T., R.M.D., Eiffelton.

EARLY ROSE.

Mother Seed—

Caldwell, G., R.M.D., Courtenay

EPICURE.

Commercial Seed—

Campbell, D., King Street, Rangiora.

MAJESTIC.

Mother Seed—

Penn, T. A., 154 Innes Road, Christchurch.

Commercial Seed—

Oakley, J. T., R.M.D., Eiffelton

ROBIN ADAIR.

Commercial Seed—

Wright, Q., Annat.

UP-TO-DATE.

Commercial Seed—

Guy, T. A. and E. B., Yaldhurst.

At the Nelson Research Orchard, under a shade temperature of 80° F., a tank surface of 20 ft. by 20 ft. loses approximately 40 gallons of water by evaporation per twenty-four hours. Under the influence of hot winds the rate of evaporation is even greater.

SEASONAL NOTES.

THE FARM.

Pasture Management.

MUCH benefit has resulted from top-dressing in July and August. Hence a farmer who has not already top-dressed as extensively as is warranted may at this stage carry out top-dressing with every confidence that he will secure good results. Ordinarily superphosphate should be used almost invariably at this season ; field trials have shown that in many important grass-farming districts it will make its influence felt substantially in four weeks from the date of its application at this time of the year. Under certain circumstances during July and August sulphate of ammonia or analogous nitrogenous manures may be applied with profit as a means of obtaining additional late winter and early spring feed. The use of nitrogenous manures for this purpose was discussed further in last month's notes.

Harrowing of pastures is advisable widely in August, and if not carried out on fields on which animal manure is plentiful the spring pasture growth will be very uneven, on account of the development of patches of rank herbage in the vicinity of where droppings have been undisturbed for any considerable period. As it is not at all easy to deal satisfactorily with rank patches of grass-growth on farms supporting principally " wet " stock, it is desirable to obviate the appearance of such patches by timely use of the grass harrows to distribute the droppings before the bulk of their fertilizing ingredients have been washed into the soil beneath.

Top-dressing of sod-bound and weedy pastures is almost certain to prove much more effective when accompanied by relatively severe harrowing. The harrowing should be severe enough to open up the turf and thereby give a chance to plants of better species, the greater growth of which is made possible by the increased fertility, to develop more vigorously. This brings about the pasture-rejuvenation which is so advisable on many old-established permanent pastures that cannot be renewed economically by putting the land under the plough.

A most important matter that many farmers will need to consider at this season is the amount and location of the grassland it is advisable to put under the plough during the next few months. In this matter a prime consideration is the adequate provision through the use of such crops as mangels, swedes, turnips, chou moellier, lucerne, and carrots of feed for the critical periods when the feed available directly from grassland is customarily below the current requirements of stock. Secondly, the ploughing-down of many pastures is called for because of their inferior swards ; often, for instance, pastures which are dominantly weeds, brown-top, or dogstail may be found occupying ground which could profitably support swards rich in rye-grass, cocksfoot, and white clover, and this especially if given reasonable assistance in the form of phosphatic top-dressing and efficient grazing management.

With past experiences in mind farmers at times hesitate to plough up pastures which they realize are not of as high a standard as could reasonably be expected in the circumstances : they doubt whether they will be able to replace the pastures which they consider relatively poor by ones which will remain superior long enough to make the undertaking a profitable one. The doubt originates almost invariably in the past use of inferior strains of pasture species which were associated with a rapid falling-off in the production of relatively young pastures and

to-day is unjustified because of the availability, through official seed-certification, of strains of seed the use of which will not lead to the disappointing results which at times occurred in the past. After making due allowance for the considerable improvement of swards that can be effected in some cases by judicious top-dressing, it may still be said that generally the most advisable method of obtaining an improved sward is by ploughing and eventual reseeding. In some instances this method, because of labour-cost or other considerations, may not be practicable, and it may be advisable to attempt to bring about sward renovation by surface-sowing of seed. It should be remembered that surface-sowing of seed is associated with risks, arising mainly from weather conditions, and is not always successful. Hence, if practicable, the sowing of seeds on a cultivated seed-bed should be followed.

Young pastures, and particularly those it is intended to make permanent, should be treated with special care during winter and early spring. The two extremes, undergrazing and overgrazing, equally should be avoided. Undergrazing is likely to occur in winter and early spring only when stock are being kept off young pastures specially to avoid "poaching" or "pugging" of the soil. It leads to the suppression or weakening of valuable pasture species such as clovers and crested dogstail, and is likely to be particularly harmful in a young pasture which contains a large proportion of Italian rye-grass—a species which should not be allowed to become long in young pastures. To avoid both undergrazing and as much poaching as practicable, sufficient stocking should be carried out, and that as far as possible only when the land is dry.

Overgrazing which readily leads to a setback to valuable species before they have properly established themselves is much more likely than undergrazing to occur in August Overgrazing in the spring is also likely to be markedly harmful to old-established swards, especially when it is associated with undergrazing in the summer and autumn as it often is. Perennial rye-grass is especially susceptible to weakening by overgrazing in the early spring. How injudicious grazing management may influence the composition of permanent pastures was illustrated in a recent report of an English investigation carried out by M. G. Jones. A pasture which continually had been overgrazed in the spring and undergrazed in the summer and autumn contained approximately 2 per cent. perennial rye-grass, 6 per cent. of white clover, and a total of 91 per cent. of useless plants, while another portion of the same pasture after only two seasons' rational grazing and identical top-dressing contained approximately 21 per cent. perennial rye-grass, 20 per cent. white clover, and a total of 52 per cent. of useless plants—still a poor sward, but nevertheless substantially improved solely by better grazing management in which overgrazing in the spring was avoided. The grazing in the spring by sheep of young pastures when not overdone is valuable because of the even, thorough consolidation of the soil which it brings about; but too-close grazing, if not guarded against, readily takes place.

Crops for Pig Feeding.

The substantial increase in pig-keeping which is expected warrants greater attention to the raising of crops suitable for feeding to pigs. There is considerable recent field experience indicating that the feeding of such crops as mangels, swedes, and chou moellier in considerable quantities in winter and early spring to pigs is giving attractive returns. Of these, the mangel is especially important both because of its high potential yield of nutriment an acre and of the fairly common belief that the mangel in some obscure way is unsuitable for pigs. Fully matured mangels have been fed widely as a substantial portion of pigs' rations with thoroughly

good results. Detailed information may be obtained on application. However, the feeding of mangels as the sole constituent of pigs' diet is not recommended, as similarly a diet of several other feeds alone, such as swedes, is not recommended, even though the safety of these crops when fed judiciously is never questioned. It is preferable that the giving of a place to mangels and similar roots in the pigs' rations be effected gradually.

In the North Island good returns have been obtained in recent seasons from feeding to pigs barley and field peas grown on the farms on which they are used. Though the experience in this respect is limited, it is extensive and conclusive enough to indicate that the growing of these crops for pigs would prove profitable at the current prices for pig-flesh over wide areas in the North Island in which little cropping is done. In some instances in which outstanding results were obtained no implements additional to those ordinarily on dairy-farms were employed—the crops were cut with the mower and all threshing was was done by the pigs. In the warmer districts it might be advisable to grow maize instead of barley.

General Cropping Work.

The ploughing of land intended for cereals should now receive attention ahead of almost all other tillage work. From experience it has become the practice to sow the greater part of the spring wheat crop in August and early September. In some districts good crops may be obtained from later sowings, but as a rule in the main grain-growing districts the yields are not so heavy from such sowings The sowing of oats ordinarily should follow the sowing of wheat as opportunity offers It often proves advantageous to sow black skinless barley in August A heavier amount of seed should be used with spring-sown cereal crops *e g.*, in the main South Island wheat-growing districts, while 1½ bushels to 1¾ bushels of Tuscan seed is accepted as suitable for autumn sowing, two bushels or more are used for spring sowing. Spring-sown cereals generally benefit from the rolling of the ground after sowing, but, except in the case of light land, the rolling, instead of being done immediately after the drilling, should be deferred until September or October.

Treatment of cereal seed for the control of disease should not be omitted in spring sowings. It seems at times to be overlooked that smut is decidedly detrimental in an oat crop which is to be chaffed, and also that the Algerian oat is subject to smut, and hence that there is just as much need to treat seed of Algerian as seed of the other varieties. The methods of treatment are discussed in the article commencing on page 43 of this *Journal.*

When it is intended to produce chaff or grain from autumn-sown cereals, the final feeding-off should take place generally towards the end of August—an exception to this being crops on such rich ground that "lodging" may be expected. It is often of assistance in avoiding "lodging" to arrange the final feeding-off of such crops to take place in September. Ordinarily after the final feeding-off the crop benefits from a stroke or two of the tine harrows for the purpose of loosening the trampled surface soil and of scattering stock droppings. Spring feeding-off of cereals should be done by stocking heavily for a short period at a time when the ground is not too wet.

Italian rye-grass or Western Wolths, which often can be sown successfully at the end of August, may be looked upon as a special forage crop capable of providing hay or silage if necessary. Artichokes, which may be sown from late August or September, according

to the earliness of the locality, thrive on land naturally suited to potatoes, but they will also yield well on comparatively poor, light soils, provided they are well manured. The crop succeeds when the seed is sown in rows about 3 ft. apart with about 2 ft. between the tubers in the rows; 8 cwt. to 10 cwt. of seed an acre is required. Generally, a complete mixture is favoured for artichokes. The ground for artichokes requires to be well worked before the sowing of the crop.

If possible grazing of established lucerne during winter and early spring in particular should be avoided. Grazing by causing consolidation favours the invasion of the lucerne by rye-grass and *Poa annua*, two of its worst and most common invaders over wide areas. Further, grazing keeps the growth short, which favours white clover, at times a serious weed in lucerne areas. Harrowing of established weedy lucerne occasionally may be advisable at this season, but generally it is inadvisable unless the conditions allow one to lessen substantially the number or vigour of the invading weeds without unduly injuring the lucerne itself. Especially in the main grass-farming districts, the only harrowing that as a rule gives this result is one carried out about January or February, when the dry conditions and the rapidity in growth of the lucerne combine to suppress weeds disturbed by cultivation. Some cultivate lucerne as a routine measure and without due thought, and often do as much harm as good or even more—any cultivation drastic enough to thin the weeds is practically certain also to thin the lucerne. Lucerne which is heavily invaded by grass should be top-dressed, not in the early spring while it is still somewhat dormant, but later on, perhaps after the first cut, when it can outgrow the grass. To top-dress in the early spring would lead to relatively greater stimulation of the grass, which would intensify its smothering effect—just what should be avoided.

Miscellaneous.

The late July-August period is a critical one in the feeding of stock. While it may be economically sound at times to allow store cattle and sheep to fall off in condition, at this period it is often a costly matter to allow milking-cows and breeding-ewes to do so. In both these types of stock production is likely to be lessened, and, in addition, ravages of disease often originate from weakened vitality which arises at this stage. Yet farmers with stock unduly low in condition at this period at times carry over reserves of feed; they would probably be wiser to use such feeds as it is required and allow the future to take care of itself.

During wet weather time may often be spent profitably in overhauling equipment in preparation for the busy season, and in the picking-over of stored potatoes. In dry weather matters to which attention often may well be given are improved farm-subdivision and the construction of pits or trenches for ensilage.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Control of Pests and Diseases.

GENERALLY, weather conditions during the past two months have been favourable for the carrying-out of the late autumn and early winter orchard operations, therefore it is presumed that the majority of orchardists already will have carried out at least the principal work as outlined in these notes for the months of May and June—*i.e.*, after-harvest-clean-up, cultivation and manuring, and pruning. The spray outfit must of necessity play an important part in orchard practice from now on until next autumn. Therefore growers who have not already done so are urged to lose no time in the

overhaul of this important orchard unit to ensure that it is in thoroughly good order for the work ahead. The hose also should be tested, and, if at all weak, should be replaced with new equipment. The dormant or winter spray for control of sucking insects such as mussel scale, San Jose scale, red-mite, woolly aphis, mealy bug, &c., on pome and stone fruit trees should be applied as early as possible after pruning, as there is nothing to be gained by delaying this spray application until a week or two prior to bud movement. Winter-spraying oil is recommended for this purpose, and should be applied during the dormant period at a 10-per-cent. concentration. Assuming that all oils are of 100 per cent. concentration the quantity of oil required is 10 gallons to 90 gallons of water. If the oil content is less than this concentration, adjustment in the dilution must be made accordingly.

To ensure a perfect emulsion soft water must be used for mixing. Hard water may be softened by the addition of washing-soda at the rate of 1 lb. per 100 gallons water. Extremely hard water will probably require the addition of a little extra washing-soda to ensure a satisfactory emulsion being obtained. The required quantity of spraying oil (say, 10 gallons) should be measured into a clean mixing container, and the same quantity of water (10 gallons) poured slowly into the oil, stirring thoroughly while the water is being added. The result, provided the necessary details are attended to, will be a milk-like solution, with no free oil in evidence. The balance of the water (80 gallons) may then be added slowly while the mixture is kept well stirred. This is a contact spray, and kills by asphyxiation the pest for which it is applied. When applying the spray the operator must be thorough, as all pests or their eggs not covered by the solution will survive and subsequently increase in numbers. Furthermore, the spray must be applied with sufficient force to drive it into all corners, crevices, and under loose bark, for it is in such places that many of the pests and their eggs, or both, are to be found during the dormant season. The spores of fungous diseases overwinter on laterals, branches, spurs, and fallen leaves and fruits. The control of important diseases of stone and pome fruits is therefore partly dependent upon the elimination of the sources of infection—*i.e.*, the removal and burning of all dead and diseased twigs and branches and the deep ploughing or digging under of fallen apple-leaves prior to blossoming, as well as the gathering and destruction of all mummified fruits on stone-fruit trees. Where practicable mummified fruits on apples and pears should also be removed. This treatment must be followed up by spraying, which should be delayed until the "bud movement" of blossom buds on stone fruits, and the "green tip" stage of buds on pome fruits, when each kind in turn should be sprayed thoroughly with bordeaux mixture 5–4–50. Much depends upon this basal spray covering in so far as the control of subsequent fungus infection is concerned. Growers are advised to take every care when making and applying bordeaux mixture to see that only the very best of materials are used, and that the application of the spray is very thorough. The following method of preparing bordeaux mixture is taken from Bulletin No. 161, "Control of Orchard Diseases and Pests by Spraying":—

"Fill the spray-tank three parts full with water; dissolve the required quantity of copper sulphate in water (3 lb. or 5 lb. for each 50 gallons of water), add to the tank and start the agitator running The copper sulphate may be dissolved with rapidity if hot water is used (5 lb. will go into solution in a minute or so in 1 gallon of boiling water), or, if first powdered, may be added directly to the spray-tank. Alternatively, it may be placed upon the strainer covering the intake, so that the incoming stream of water carries the particles into the tank, in which case it will go into solution within two minutes. When the dissolved copper sulphate has been added, weigh out the required quantity of commercial hydrated lime (4 lb. for each

50 gallons of water), mix to a thin paste with cold water, and with the agitator still running pour slowly into the tank, at the same time filling the tank to its capacity. Keep the agitator running for a further few minutes and the spray is then ready for application.

"The hydrated lime must be of good quality, containing not less than 90 per cent. of $Ca(OH)_2$; if the content is less than this, adjustment must be made accordingly."

—*J. W. Whelan, Orchard Instructor, Palmerston North.*

Citrus Notes.

At this period of the year, when the gathering and marketing of the Kawau Orange (Poorman) is being undertaken, it is very important for growers to realize the double purpose for which this fruit is used. It is of great value as a marmalade orange, and is also used extensively for juice purposes However, it is well to remember that the seasons for picking for the different uses are not identical, and unless the fruit is harvested at the appropriate time according to the use to which the fruit is to be put the greatest value will not be obtained.

The best season for marmalade purposes is during the months of June and July, or, in other words, just when the outer skin of the fruit is commencing to turn from the green to the yellow. During this period when made into marmalade it jells more freely than if used later in the season. If used for juice purposes in this early stage it does not impart the satisfaction that it does when picked for the purpose at a later stage. There is every indication of this fruit coming into great favour, and the consumption will increase rapidly as the years advance, providing growers realize the definite distinction between the season for marmalade and that in which it should be used for juice purposes Not only does the quality of the juice increase by the fruit remaining on the tree for a while longer, but the quantity also increases It can be assumed safely that in the very near future this orange-drink will become one of the most popular thirst-quenching and appetizing juices. Hence growers are urged to keep in mind the great necessity of educating themselves and also the buyers along the lines indicated, in order to stimulate greater consumption.

Every provision already should have been made for new plantations, and if this has not been done it would be much better to delay the planting for a season.

Good shelter, thorough conditioning of the land, and adequate drainage are of the first importance. If the land is not of a porous nature, so as to permit the surplus water to drain freely away, underdrainage must be provided. Tile drains of suitable dimensions according to the length of drain are the most satisfactory. Drains of logs and brushwood, although useful under certain conditions, are not altogether suitable or satisfactory except for a short period.

Where everything is in readiness for planting and the soil is in a suitable condition the trees could be planted now. However, if the soil is wet, it would be better to defer planting until later, as it is not good orchard-practice to plant out trees where the soil is wet and cold.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Time to Hatch.

AUGUST and September are recognized as being the best months of the year for hatching out chickens for the renewal of stock. It should therefore be the aim of all poultry-keepers to secure the required number of young birds before the end of September. If chickens are to develop into really profitable stock, it is imperative that they be well over the brooder

stage before the hot summer weather sets in. The production of late-hatched stock is the weak link on many unsuccessful plants. There are no chickens that do so well as those which develop as the days are lengthening rather than when they are on the wane.

Inbreeding.

Several inquiries have reached me of late in regard to mating stock. In some cases the inquirers have suggested close inbreeding, and are desirous of knowing whether the pullets produced from such matings would possess heavy egg-yielding power. Such inquiries cannot be answered with any degree of satisfaction. It is true that no great advance has ever been made in the improvement of type in domestic stock without inbreeding of the selected foundation animals, but there are serious dangers attaching to this method of fixing type, especially if the inbreeding is followed out without any definite method or aim. The danger is particularly great with poultry. It is a simple matter to advocate inbreeding or to talk about it, but to advise others how to carry it out successfully is an entirely different matter Indeed, to advise poultry-keepers generally how to inbreed, when to inbreed, and when not to inbreed, as a means of promoting or maintaining heavy egg-production without being familiar with the stock and their surrounding conditions is an absolute impossibility.

In the first place, it is necessary to study the bird to be bred from, whether it be a cock or a hen. The birds must conform to desired shape, and some definite knowledge must be possessed of pedigree and egg performance, together with the relationship of the birds to be mated, in order to have some guarantee that the type aimed at will be secured Unless exact principles are adhered to, inbreeding will probably bring about a deterioration in the stock which will prove disastrous Many troubles are being experienced to-day in the way of weedy stock, disease, parasitic infestation, and the production of small eggs, as a result of inbreeding, not so much from the inbreeding deliberately done with stock of which the true history is known, but from that regrettable inbreeding arising from a want of knowledge of the stock being handled. Quite often this ignorance regarding the breeding birds is not the fault of the breeder, but is the result of some specialist breeders who designedly or unknowingly do not possess an accurate knowledge of the strains with which they are working or sending out for breeding purposes During my experience I have often received requests for cockerels of a certain breed to mate with hens of say Mr. B.'s strain, and as Mr B. had only Government stock the inquirer is practically asking in all innocence for a related bird. We cannot know too much about the pedigree of the birds we desire to breed from. Unfortunately the life of the domestic fowl is too short to warrant the compilation of stud-books that would serve a generally useful purpose, and the purchaser must necessarily depend on the breeder's word as to the bird's breeding This naturally tends to loose breeding methods, which render it a most difficult matter to place poultry-breeding on that sound foundation so essential to the best results. As previously indicated, judicious inbreeding is one of the chief secrets of success in advancing type, but it is likely to prove a pitfall to the inexperienced, and even to the keen enthusiast it is fraught with danger in the absence of the exact knowledge necessary to its successful application. To the breeder who is aiming at an ideal type, and who has a keen eye for selecting form with special breeding power, and has suitable environment for rearing his stock, together with the ability to rear and manage poultry on sound lines, close inbreeding may be resorted to as a means of improving or maintaining desired qualities in a strain—whether it be in respect to egg-production or to maintaining breed characteristics. On the other hand, to the man who does not possess these qualifications or the conditions referred to inbreeding will,

in all probability, have the effect of weakening a strain rather than advancing it. It will thus be seen that, in regard to this matter, there is no theoretical course which can be recommended to suit all cases and conditions alike. The chief aim where inbreeding is resorted to is to intensify, if possible, desirable characteristics, but it must be remembered that any undesirable characteristics as well as the good ones are intensified ; so that where stock are not of a high standard as regards the object aimed at, of what avail is it to continue close inbreeding ?

For example, say a strain gave evidence of being on the down grade in size and constitutional vigour, then to inbreed would in all probability mean that the subsequent generations would become smaller and weaker as time went on. In such cases, rather than inbreed the aim should be to introduce fresh blood possessing strong points where the others are weak. In other words, mate with a view to improving existing good qualities, or, on the other hand, for the elimination of bad ones. When introducing fresh blood it would be advisable to first try it out with a small number of birds, or, better still, with an individual bird in order to prove whether the union gave a desired result. Very often, even when two good strains of the same breed are mated, the one may not " nick " with the other and may thus produce a full crop of disappointments by way of latent undesirable characteristics. Like does not always produce like, and, whatever system of breeding in resorted to, the law of variation will at times upset the best breeders

In mating birds some men are specially gifted with an eye for form, and are thus able to a great extent to select prepotent specimens, that is o say, those birds which will stamp qualities possessed by themselves on their progeny Such men are born breeders, not made ; and so long as they know the family history of the strain they are working with they may possibly inbreed from generation to generation over a long period of years and still hold the desired qualities aimed at in the particular strain In regard to inbreeding, especially when practised by the novice, the risk of losing size and constitutional vigour is the chief danger, and probably there is no other class of live-stock where constitution is of such importance as it is in the case of the modern type of high-laying fowl, in view of the fact that the reproductive organs are put to such a severe test in producing its artificially forced egg-yield. Of course constitution is not everything, but without constitution it is useless attempting to develop or maintain a desired type. It is one thing to attain an ideal but quite another thing to maintain it. For example, it would be a mistake to select a bird solely on constitutional points. These must be accompanied by the characteristics it is desired to develop. In advancing egg-yielding capacity, however, the hens which attract the male most forcibly are invariably the best breeders, and therefore, if a laying strain, will be the heaviest layers. It is a good plan to note the hens the rooster prefers, an indication of which is often afforded by the condition of the feathers on the back of the hens. If these are cut about it proves that the bird is one specially selected by the male, and a demonstration is thus provided of the best guide to breeding power-- nature's selection. Nature, after all, is the best guide we have. Inbreeding apparently does not trouble rabbits and sparrows. Nature provides for the elimination of the unfit. Constitution is maintained without the necessity of imparting fresh blood, and not withstanding natural enemies—poisons, &c., and with no assistance from man—these pests multiply with amazing rapidity.

Referring again to inbreeding, and particularly in- and in-breeding, the writer cannot recommend it so far as the average poultry is concerned. To sum up, it is really like a two-edged sword, which cuts both ways. In the hands of the right man and one who may be termed a breeder, then it is all right; but, on the other hand, when practised by the wrong man it

may easily mean the ruination of a strain. In the production of heavy-laying stock the selection and mating are merely links in the chain of management. The feeding, the housing, the rearing, and the general environment of the stock are essential factors if the desired ends are to be reached.

The Moulting Birds.

A correspondent whose adult hens have not laid for many weeks past asks whether it would not pay better to cull out the birds rather than to continue feeding them for nothing. Although these fowls have been earning nothing during the past few months, he and other poultry-keepers in a similar position are advised not to resort to drastic culling at this time of year. This work should have been done in the autumn. The natural laying-season for bird-life is approaching, however, when even the sparrows will be laying, and it will be a very inferior fowl that will not pay her way before the next moult comes on. Of course, the better the feeding and general amanagement a bird receives the earlier she will come into profit.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Winter Conditions.

As indicated last month, there is little a beekeeper can do for the welfare of his bees at this period beyond examining the hives for leaky covers and damp mats, which if found should be replaced. All manipulations of the bees should cease, and the bees, having been made as snug as possible, left until the arrival of the warm spring days.

Locating an Apiary.

As the supply of grass and clover regulates the amount of stock carried on a given area, so does the same condition apply to what might be termed the grazing of bees. Unrestrained and at liberty, the bees fly where their desire prompts them, even to a distance of three or four miles from their home; but this is not necessary if a suitable site has been chosen. Rich land where clover grows abundantly and little cultivation is done is more suitable for beekeeping than any other kind; and land of this description may be found in any dairying or bullock-fattening district. Sheep-grazing land is usually eaten too bare, yet occasionally I have heard of good flows of nectar from valleys in such areas. Plenty of willows scattered over good country add materially to the value of a district in supplying early spring bee-feed; while a patch of native bush close by would also be advantageous in this respect. Catsear is also valuable as a nectar-producing plant, the honey being of an amber colour, smooth-grained, and of good flavour. After clover has finished blooming, thistles, if in any quantity, may be expected to furnish an excellent honey of a white colour, and this, blended with clover and catsear, forms a very fine product, and always commands the highest price.

Shelter.

Next to selecting a good locality, arranging for good shelter is the most important matter. The formation of the neighbouring ground would perhaps assist in this respect. If there is any choice, select a low, well-drained spot, which will enable the bees to fly down when loaded for home. Such a position will also lend itself more readily to being sheltered. It is preferable to make use of natural shelter, if

handy, providing the trees are not too large to cause a draught; where there is open country I would advise putting up a temporary fence of boards or brushwood on the sides of the prevailing winds until a substantial green fence has grown. Tagastaste (*Cytisus proliferus*), sometimes called "tree-lucerne," grows very rapidly, and makes a good shelter in two seasons. It should be planted about 2 ft. 6 in. apart, and the ground round the roots kept free from weeds. It stands a great amount of cutting, and flowers along the branches very early in spring, thus forming a very welcome addition to other early honey-producing plants.

Bees should not be placed too closely under big trees or immediately under hedges, or in any damp place, for under these conditions they become irritable, and the combs are liable to get mouldy. Bees require shelter, but at the same time plenty of sunlight.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

THERE is appreciable growth of hardy crops during the month of August in most parts of the country—it is literally springtime. Established crops of asparagus which received generous manurial treatment in summer after cutting, or during the winter, will now receive benefit from a dressing of nitrate of soda or other form of nitrogen applied at monthly intervals during the cutting-season. On light land a dressing of sulphate of potash in addition to the nitrate should be applied to a limited area to test its effect. The cabbage crop for early spring cutting may also be forced by similar manurial treatment: the potash will balance the effect of the rather generous use of nitrates, especially by preserving the colour. Early lettuce may be given a similar attention.

New plantations of asparagus may now be made, but a "rush job" should be carefully avoided. Planting must not be done unless the preparation of the land is complete - that is, mainly, it is clean, rich, and deeply cultivated—and good, graded roots are available for planting. It is well to crop the land with potatoes or other annual crop for another season if there is any doubt about it being ready for planting the asparagus. Where planting is to be done twelve months hence, sow the seeds now in order that the crop may have a long season of growth and sturdy one-year-old roots will be available for planting out next year. Meanwhile select the land for planting, and let all the operations upon it during the ensuing twelve months have this end in view.

Early peas, broad beans, radish, white turnips, short-horn carrots, globe beet, and parsnips, main-crop onions, lettuce, round-leaved spinach, and parsley, as well as seed-beds of cabbage and cauliflower, should now be sown. In dry districts where summer cabbage is difficult, silver beet and New Zealand spinach are excellent substitutes and may be sown now, the former outside and the latter under glass (or outside in October). Preparation of the land includes broadcasting any necessary fertilizers and cultivating them in a week or two before sowing the crop. This cultivation should be shallow to avoid bringing to the surface more weed seeds.

Parsnips should be lifted and stored in a cool place before the flavour is spoiled by the roots making fresh growth. Celery will also require a similar attention. Where leaf-spot has been troublesome all waste should be destroyed carefully to avoid infection.

Making a Hotbed.

In a sheltered, sunny, well-drained position it is not difficult to make up a hotbed for raising half-hardy plants for setting out in the open early in the month of November Tomatoes, egg plants, chillies, melons, cucumbers, marrows, and celery are amongst the many kinds of crops that may often be sown with advantage in boxes towards the end of August, and started on a hotbed. The heat for the purpose is usually obtained from fresh strawy stable manure that has been treated to bring about a general state of fermentation throughout the whole mass This is done by stacking the material in a compact manner under cover, in a few days when fermentation is well established it should be turned, shaken out, and again restacked, damping-down any dry material meanwhile. By repeating this treatment two or three times fermentation becomes general. The bed is then made by spreading the material evenly and treading it firmly—building a neat solid stack of the desired height and area The frame may then be placed in position, and in a few days, when the heat has steadied, after the bed has been thoroughly watered and the glass sashes placed in position, it is ready for use In northern districts very little material is necessary to maintain a bottom heat of about 60° to 70° F, which is desirable. In colder localities more material will be required to maintain this temperature during cold weather, but assistance can be given on frosty nights by covering the glass sashes with mats Where stable manure is scarce, the supply may be supplemented with leaves gathered in the autumn, where they are available

It is a mistake to grow the plants just mentioned in an over-rich compost. The aim should be to grow hardy plants—a soil composed of good fresh loam, with a small amount of decayed manure or leaf-mould to provide humus and sharp sand to lighten the material, if necessary, is all that is required.

The preparation of the land for planting out these crops should proceed while the young plants are being grown. Turning under a green crop and working in a dressing of fertilizers, with occasional shallow cultivation to destroy weeds, are usually the main features of this preparation.

Small Fruit Crops.

A crop of Chinese gooseberry (*Actinidia chinensis*) seen recently had made an unwieldly mass of tangled growth, with a heavy crop of fruit on spurs, and young wood of moderate size. Plants may be set out now in localities that are fair to warm, and in a rich, moist soil. They require a trellis or pergola to accommodate them, and leading growth must be controlled. The plants are diœcious—that is, there are separate male and female plants—so consideration must be given to pollination. Although not showy, it is a handsome plant; the fruit, ripening late, comes in at a useful time when variety is somewhat lacking. The fruit also has quite good carrying and keeping qualities.

The white sapote from Mexico (*Casimiroa edulis*) is another new fruiting-plant that has been introduced. It is a strong-growing evergreen tree with large divided leaves. The fruit has a tender yellow skin and soft cream flesh of a delicate flavour without acidity; it ripens during the autumn. The tree is said to be very prolific, and individual fruits sometimes measure 3½ in. in diameter; it should be

planted only in a soil and climate suited for lemon-growing. It has distinct possibilities in the home garden and for local marketing, but its carrying qualities are rather doubtful.

Ground should be prepared for planting out passion-fruit and tree tomatoes (*Cyphomandra betacea*) during the months of September and October. Seeds of passion-fruit may be sown in the row where they are to grow, or in boxes and grown on for planting out twelve months later.

Gooseberries, currants, raspberries, loganberries, &c., should now be planted out as soon as possible. Where planting is to be done twelve months hence, commence the preparation of the land now. Grass land or weedy ground will take the greater part of that time to break in satisfactorily: success chiefly depends on doing this well.

Most plants of this class are affected by "leaf-spots" of different kinds, due to the attack of fungous organisms, many of these seriously affect the health and cropping capacity of the hosts, and should be prevented by timely applications of a fungicide spray. As the initial and most dangerous attack takes place in early spring, a thorough application of bordeaux 4–4–50 should be made shortly before growth commences, and repeated at intervals of about three weeks, as may be necessary, with a somewhat weaker mixture. Where leaf-roller or other chewing larvæ are troublesome, arsenate of lead may be added to the bordeaux at the rate of 2 oz. of paste or 1 oz. of powder to 4 gallons of spray. The lead should be placed in a small basin and worked up to a cream with a small quantity of water before diluting it further.

The Homestead Garden.

The present time is most suitable for planting most kinds of trees, shrubs, and other perennial plants, and this should be done as soon as the preparation of the land is completed and the soil is sufficiently dry. In dry districts especially, late planting is attended with considerable risks, which may be avoided by planting before the end of August. The same precaution should be taken in sowing down lawns, as unless the grasses are well established before the arrival of dry weather the competition of weeds is likely to be a serious matter. A good dressing of fertilizers hoed in some time before sowing will help in the quick establishment of the grasses.

It is well to sow now sweet peas and other hardy annuals outside, and half-hardy annuals under glass for planting out in November, and also to finish pruning roses, except in the colder localities, where it is better deferred until early in the month of September.

On new sections shelter-belts, hedges, drainage, and roads and paths for access are most urgent and should receive first attention. They are the important features in any layout, and should be given a great deal of consideration. Very few crops are grown satisfactorily without ample shelter and good drainage, and because of the permanent character of these improvements they should be well carried out · by extending the shelter-planting with acacias and gum-trees a good supply of firewood and useful timber may also be obtained. If roads and paths are well cambered with culverts at necessary points to get rid of the water they will give good economical service. Most important is it that these features should be well graded at the right level; they will then give better service and a very much improved appearance to the property.

—*W. C. Hyde, Horticulturist, Wellington.*

LICENSED MEAT-EXPORT WORKS IN NEW ZEALAND, SEASON 1934-35.

Name and Address of Licensee.	Name and/or Location of Works	Beef-killing Capacity per Day.	Sheep-killing Capacity per Day.	Storage Capacity in 60 lb. Carcasses Mutton.
North Auckland and Auckland.				
Auckland Farmers' Freezing Co., Ltd., Auckland ..	Moerewa ..	200	4,000	165,000
„ „ „ ..	Southdown .	150	5,000	190,000
„ „ „ ..	Horotiu .	200	4,000	310,000
Westfield Freezing Co., Ltd., Auckland	Westfield ..	250	5,000	264,000
R. and W. Hellaby, Ltd., Auckand	„ ..	200	2,000	100,000
Gisborne				
Gisborne Refrigerating Co., Ltd., Gisborne	Kaiti ..	175	7,000	200,000
Gisborne Sheep-farmers' Frozen Meat and Mercantile Co., Ltd.	Tokomaru Bay	60	3,000	130,000
Hawke's Bay.				
Nelson's (N.Z.), Ltd., Tomoana	Tomoana .	150	7,000	150,000
Hawke's Bay Farmers' Meat Co., Ltd., Hastings .	Whakatu .	100	8,000	180,000
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa ..	Wairoa*	100	3,000	70,000
Taranaki				
Thomas Borthwick and Sons (Aus.), Ltd., Masterton ..	Waitara ..	350	4,500	80,000
J. C. Hutton (N.Z.), Ltd., Wellington	Eltham ..	60		25,000
Patea Farmers' Co-operative Freezing Co., Ltd., Patea..	Patea .	150	3,800	180,000
Wellington				
New Zealand Refrigerating Co., Ltd., Christchurch	Imlay	200	7,600	203,000
Thomas Borthwick and Sons (Aus.), Ltd., Masterton	Feilding ..	100	3,500	96,000
National Mortgage and Agency Co. of New Zealand, Ltd (Head Office, Dunedin)	Longburn ..	80	4,000	80,000
Thomas Borthwick and Sons (Aus.), Ltd., Masterton .	Waingawa .	300	7,000	125,000
Gear Meat Preserving and Freezing Co. of New Zealand, Ltd., Wellington	Petone	100	10,000	300,000
J. C. Hutton (N.Z.), Ltd., Wellington . .	Ngahauranga	120	3,000	120,000
Wellington Meat Export Co., Ltd., Wellington	„	120	8,000	240,000
„ „ „ ..	Kakariki† .	100	7,000	90,000
Marlborough and Nelson				
New Zealand Refrigerating Co., Ltd., Christchurch ..	Picton .	30	2,400	30,000
Nelson Freezing Co., Ltd., Nelson	Stoke	30	500	50,000
Canterbury.				
Canterbury Frozen Meat and Dairy Produce Export Co., Ltd., Christchurch	Belfast .	120	5,000	170,000
Ditto	Fairfield	..	4,500	100,000
„ ..	Pareora .	25	5,000	233,000
New Zealand Refrigerating Co., Ltd., Christchurch .	Islington	50	9,000	258,440
„ „ „ .	Smithfield .	50	5,800	300,000
North Canterbury Sheep-farmers' Co-operative Freezing Co., Ltd., Christchurch	Kaiapoi	..	5,000	222,000
Thomas Borthwick and Sons (Aus.), Ltd., Masterton .	Belfast ..	.	6,500	70,000
Otago.				
Waitaki Farmers' Freezing Co., Ltd., Oamaru ..	Pukeuri ..	.	4,500	130,000
New Zealand Refrigerating Co., Ltd., Christchurch ..	Burnside ..	36	3,500	161,838
South Otago Freezing Co., Ltd., Balclutha	Finegand ..	50	3,500	200,000
Southland				
Ocean Beach Freezing Co., Ltd., Invercargill .	Ocean Beach ..	80	9,000	120,000
Southland Frozen Meat and Produce Export Co., Ltd., Invercargill	Mataura .	50	4,000	124,000
Ditto	Makarewa ..	120	4,500	122,500
Totals		3,900	179,100	5,580,778

* Reopening, season 1934-35; disorganized by earthquake and fire in February, 1931. † Not operating.

—*Live-stock Division.*

When inspecting a top-dressing trial at Otaki, farmers agreed in considering super better than slag, and both much better than African and Nauru phosphates As it was fourteen months since any manures had been applied, this was an interesting sidelight on the lasting effect of superphosphate

WEATHER RECORDS: JUNE, 1934.

Dominion Meteorological Office.

NOTES FOR JUNE.

JUNE was, on the whole, a rather cold month, with less sunshine than usual. Until the last few days there was comparatively little wind, so that the low temperatures did not produce harmful effects. As regards total rainfall, conditions varied considerably in different districts, but generally it was rather humid.

Rainfall.—Owing chiefly to the heavy rains from the 18th to the 20th, practically the whole of the Auckland Province except the Poverty Bay and East Cape areas had considerably above the average rainfall for June. The same was the case in Nelson, Marlborough, and Southern Wellington. Over the east coast districts of the North Island, in Southern Taranaki, and Northern Wellington the totals fell short of the average. In the parts of the South Island not mentioned, the distribution was irregular, with totals below the average predominating. Generally, the number of rain days was high, so that even where the total rain was low the month was effectively a wet one. The storm of the 18th to 20th mentioned above was responsible for many very heavy rains from Nelson and Marlborough northwards.

Temperatures were for the most part slightly below normal, but the departures were important only in eastern districts and parts of the interior. At many places in western districts the normal was just exceeded. Owing to the still weather, many hard frosts were recorded. In the cold and boisterous weather at the end of the month there were heavy snowfalls on all the ranges, and even on much of the plain country of the South Island and the central plateau of the North. There were snowfalls on the Canterbury Plains also on the 9th.

Sunshine was everywhere considerably below normal. The best totals were recorded at Tauranga 149·6 hours and New Plymouth 136·7 hours.

Pressure and Weather Systems.—During the greater part of the month such storms as occurred were rather complicated in structure but not very vigorous. They consisted of irregular troughs of low pressure running in a north to south direction, there being a tendency for the lowest pressure to occur over the northern extremity of the Dominion. The first of these depressions passed on the 2nd, and was responsible for widespread rains with many heavy falls.

Later north-easterly gales arose in the far North and prevailed in some parts of the North Island until the 20th. Very heavy rains fell in the North, and by the 20th the area of precipitation had covered practically the whole of the Dominion.

On the 27th a much deeper trough of low pressure than had been experienced for a considerable time began to approach the Dominion from the Tasman Sea, and on the 28th a depression crossed the country and a southerly change advanced over the South Island. At this time pressure had become very high at Hobart, so that the invasion of cold air from the South was a very vigorous one. Snow commenced in the South that day, and hailstorms also were numerous. These conditions of southerly gales and intermittent heavy rains, with widespread snow and hailstorms, continued into July. Thunderstorms also occurred in many places. On the 25th a small tornado occurred near Opotiki.

RAINFALLS FOR JUNE, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.	Total for Year to Date.	Average for Year to Date.
			North Island			
	Inches		Inches	Inches	Inches.	Inches.
Kaitaia	9·54	18	3·43	6·59	25·49	28·16
Russell . ..	13·25	18	5·10	6·49	32·79	27·33
Whangarei	10·51	21	2·61	6·54	28·58	31·60
Auckland	6·48	19	2·15	4·95	26·81	21·99
Hamilton . ..	6·39	15	2·36	5·11	21·88	23·90
Rotorua	8·94	14	4·96	5·25	26·85	26·87
Kawhia . .	5·74	15	1·77	5·72	27·95	25·54
New Plymouth .	7·00	15	2·15	5·98	26·37	28·46
Riversdale, Inglewood .	8·92	15	2·73	10·27	38·45	48·65
Whangamomona .	5·10	8	1·53	7·89	33·91	35·70
Hawera .. .	3·85	14	0·77	4·41	21·08	21·39
Tairua . .	8·97	14	2·25	6·97	28·41	33·56
Tauranga ..	7·45	16	3·75	5·40	28·83	26·86
Maraehako Station, Opotiki	7·81	15	2·57	5·66	23·80	27·79
Gisborne .. .	2·03	13	0·91	4·90	13·19	24·91
Taupo .. .	5·40	14	2·63	4·56	22·61	21·36
Napier	2·87	14	1·26	3·45	16·31	18·71
Hastings .. .	2·30	13	0·96	3·07	13·90	16·63
Whakarara Station .	5·46	9	3·60	.	27·50	..
Taihape	2·67	14	0·58	3·46	24·71	17·71
Masterton .. .	2·89	19	1·23	3·63	16·96	18·83
Patea . ..	3·13	14	0·61	4·24	20·90	21·40
Wanganui	2·01	13	0·44	3·37	18·70	17·70
Foxton . .	3·24	11	0·64	3·39	16·06	15·27
Wellington .	4·81	20	1·24	4·19	20·82	20·29
			South Island			
Westport	7·88	15	2·14	8·85	48·26	46·50
Greymouth	13·50	14	3·90	8·80	50·54	49·56
Hokitika	8·10	15	2·29	9·32	47·12	55·16
Ross	6·31	10	2·00	8·73	61·41	62·77
Arthur's Pass.. ..	11·27	9	4·47	10·53	77·30	75·94
Okuru, South Westland	..	..	.	10·72	..	72·04
Collingwood	14·35	18	4·22	10·30	39·81	45·08
Nelson	5·52	15	1·16	3·53	16·64	18·30
Spring Creek, Blenheim	5·35	16	1·75	2·94	13·74	14·47
Seddon	3·06	12	0·97	2·09	13·21	12·32
Hanmer Springs ..	2·58	15	0·86	3·49	31·11	21·61
Highfield, Waiau ..	1·73	9	0·60	2·47	21·22	16·74
Gore Bay	2·06	14	0·40	2·69	22·95	15·87
Christchurch	1·34	14	0·30	2·66	16·56	12·93
Timaru	2·28	9	0·70	1·72	16·91	11·08
Lambrook Station, Fairlie	2·11	11	0·38	1·86	17·50	11·98
Benmore Station, Clearburn	1·89	11	0·40	1·81	13·75	12·80
Oamaru	1·58	12	0·54	1·98	12·87	10·98
Queenstown	1·22	9	0·37	2·29	16·09	15·28
Clyde	0·83	7	0·28	0·92	11·40	7·76
Dunedin	1·04	14	0·34	3·16	21·62	18·13
Wendon	1·23	9	0·30	2·59	15·91	15·48
Balclutha	2·46	13	0·46	1·99	17·82	12·71
Invercargill	2·46	14	0·40	3·72	21·95	23·17
Puysegur Point ..	4·67	22	0·60	6·59	33·65	42·26
Half-moon Bay ..	2·43	16	0·52	4·91	23·49	29·13

RAGWORT.

ST. JOHN'S WORT.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

ST. JOHN'S WORT AND RAGWORT.

A. C. C., Moa Flat, Heriot :—

What is the difference between St. John's wort and ragwort, and how do they affect sheep? Does ragwort discolour the carcasses of sheep killed for mutton?

The Fields Division :—

St. John's wort (*Hypericum perforatum*) is a perennial, and grows to a maximum height of about 2 ft., but seldom more than 1 ft. 6 in. The stem is stiff and erect. The leaves are opposite and stalkless, so that the stem appears to "perforate" them. The leaves are about ½ in. long, green in colour, with a slight bluish-green tinge, and covered with tiny transparent dots, indicating the presence of oil glands. The flowers, about 1 in. in diameter, are bright yellow, five-petalled, star-like, and are borne in large terminal clusters. A striking part of the flower is the great number of long yellow stamens. St. John's wort seeds abundantly, and the seeds are contained in capsules. It has a twitchy creeping rootstock, which is fragile, as well as deep-penetrating roots, and is stimulated by ordinary methods of cultivation. It flourishes on free friable soils, and is a particularly common plant in the Queenstown district. Ragwort (*Senecio Jacobaea*) is better known on account of its wide distribution throughout both Islands. It is a perennial, springing from a thick rootstock, with abundant shallow roots, but there is no tendency in the rootstock to creep. The stems are stiff, upright, and much branched below, and reach a height of from 3 ft. to 5 ft. The leaves are irregular and pinnatifid. In colour the leaves are dark green on the upper surface, rather paler on the under surface. Some spring from the roots and have quite long stalks, others spring from the stem, these latter having no stalks, but clasp the stem closely. In the flowering season the stems branch very much above, the flower-heads being arranged in large clusters, but are all cut off at the same level and form a flat-topped bunch. The flower-heads are about 1 in. in diameter and bright yellow in colour. The cup underneath the flower-head is made up of scale-like leaves with black tips. Ragwort is readily distinguished from St. John's wort in that it is a taller, more robust plant, with irregular pinnatifid leaves, and the rootstock does not possess a creeping habit. Although St. John's wort is regarded as being dangerous to stock, it is not readily eaten, therefore being unpalatable it is only under "starving" conditions and where large quantities are consumed that stock mortality is likely to occur. Ragwort is particularly poisonous to cattle and horses. Sheep, however, resist the poisoning action to a much greater extent, and it is a common practice to control ragwort-infested properties by stocking with sheep. However, continued grazing by sheep of ragwort areas proves dangerous and mortality is likely to occur. A noticeable symptom is the yellow colour, affected animals being referred to as "yellow sheep," and it is stated that discoloration of the carcass occurs also.

Illustrations of the plants appear on the opposite page.—EDITOR.

SOWING CUPRESSUS LAWSONIANA AND MACROCARPA.

JOHN T., Mataura :—

When is the time to sow seeds of *C. macrocarpa* and *C. Lawsoniana* in Southland?

The Horticulture Division :—

In southern districts it is generally best to sow *Cupressus Lawsoniana* and *C. macrocarpa* in wide drills on prepared beds about 1st October, when the land is dry. Firm the seeds in the drills and cover lightly with screened soil containing a sufficient proportion of sand to prevent crusting.

SAND IN STOMACH OF SHEEP.

A. S. McI., Ruakituri, Wairoa, H.B. :—

I am sending you a sample of sand taken from the third stomach of a sheep. There was a considerable amount of this mixed with a watery fluid. (The sheep was in very poor condition with its wool very rough looking.) The first two inches of the intestine was enlarged to about twice the usual size, and the internal passage seemed to be almost entirely blocked with the sand. Do you know any way of curing sheep so affected ?

The Live-stock Division :—

The finding of sand or other foreign matter in one of the stomachs of ruminants is not uncommon. When, however, this foreign matter is so plentiful as to be found in the small intestines and other parts of the alimentary canal, the possibility of a mineral deficiency cannot be overlooked. When a deficiency exists in a pasture the animals are inclined to eat earth and sand in an attempt to make good the deficiency. In your high country, especially with a heavy rainfall, a mineral deficiency in all probability exists. The provision of a mineral lick to be placed in boxes on the camping-sites is recommended. A suitable lick may be prepared by mixing forty parts of agricultural salt with forty parts of sterilized bone-meal or bone-flour and twenty parts of limonite. Limonite is a compound of iron found in the North Auckland district. The lick should be placed in covered boxes protected from the prevailing wind.

SOYA BEANS IN CANTERBURY.

L. W. S., Clandeboye :

Would the Soya bean grow successfully in South Canterbury ? If so, what month is most suitable for sowing, and what seeding is required ? Could you also tell me where the seed can be obtained, and give information as regards tillage of ground and manuring ?

The Fields Division : --

Little is known about the behaviour of Soya beans under Canterbury conditions. A number of trials were carried out at Christchurch in 1912 and 1913, but these were not very successful, although some of the varieties grew moderately well. The Department carried out a number of variety trials with Soya beans some years ago in the North Island, and quite a number of the varieties did well, but it was considered that any use they could be put to seemed more easily filled by other crops such as wheat, peas, &c. Soya bean seed is not readily procurable in Canterbury, but the firm of Arthur Yates and Co., seed-merchants, of Auckland stocks two varieties, Manchu (which is stated to be a dwarf early-maturing variety) and Beloxi (a tall late-maturing variety). Soya beans will not withstand frost, and this suggests for Canterbury the use of the earlier-maturing variety. Seed sown in November should normally be ready for harvesting in April. The seed should be sown in rows sufficiently far apart to permit of some intercultivation. The amount of seed per acre will depend on the germination, and the row spacings. For normal seedings of good germinating seed, the seeds in the rows should be about 1 in. apart. A suitable fertilizer to apply with crops of this nature is carbonate of lime and superphosphate in equal parts sown at the rate of about 3 cwt. per acre. Basic super will also give good results, but heavy applications of super alone are liable to seriously retard germination of seed.

PAMPAS GRASS IN BRACKEN FERN.

W. B., Niagara :—

If I plant pampas grass amongst bracken fern would the pampas grass smother the fern out once it got established ?

The Chief Chemist :—

The young plants of pampas would have to be protected against competing bracken until they were tall enough to dominate the fern.

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SOME DISEASES OF PIGS.

D. MARSHALL, Veterinarian, Department of Agriculture, Hamilton

SOME of the complaints most frequently causing losses in pigs are considered briefly below :—

Troubles with Baby Pigs.—Pigs being born dead is not an uncommon happening. In some cases the little pigs are fresh, full size, and normal. These pigs were probably alive at commencement of birth, but were smothered in the membrane. If attention had been given when they were being born, the membrane removed and the nostrils cleaned, they might have been saved. In other cases there is evidence that the pigs have been dead within the mother for six weeks or so. In many cases the cause can only be surmised. However, a check in the nutrition of the pregnant mother is one definite cause. A similar condition has been seen in lambs born of ewes which earlier in pregnancy had a check and were short of food. One has seen it occur in sows running out, where the feed-grass became dry and unnutritious, and no supplement was allowed. Iodine shortage in certain areas in the United States of America has been associated with little pigs being born weakly or dead. Evidence of this (goitre, hairlessness) has not been noted here, but one large breeder said that since feeding iodine to pregnant sows, he had fewer weakly pigs born.

Contagious abortion infection has not so far been found in pigs in New Zealand. Therefore to avoid losses with baby pigs one should see that the pregnant sow, without becoming too fat and lazy, is getting sufficient nourishment, particularly protein, that adequate minerals are available, and it may be advisable to give a trace of iodine at intervals.

Deaths in Pigs at One or Two Days old.—Some of these are undoubtedly due to management. The sow should have a certain amount of laxative food just before and after farrowing. She should not be overfed; in fact, kept rather short for a day or two, provided sufficient fluid is available. Constipation should be guarded against. The udder should be clean, so that when little ones first suckle they do not get a mouthful of filth. Some believe in taking the piglets away while the sow is farrowing, and this may prevent some being crushed, but if it is done they must be kept warm and comfortable. The sow should be disturbed as little as possible during the first couple of days, since nervous sows become upset.

In many cases scours in little pigs can be traced to feeding of sow. Excess of diet high in protein, a change of diet, too many roots. In

one case where conditions were otherwise ideal, the sows were eating very succulent young grass, in certain runs. It was found that scours were prevalent in all the little pigs, but did not affect the few litters the mothers of which were in somewhat barer runs. In other cases the scour is of an infectious nature, sometimes definitely due to *Bacillus suipestifer*, to be mentioned later. In one outbreak of this trouble where sows were being farrowed in sties, all efforts in the way of altering diet, &c., of the sow failed to check the trouble, till the method was changed and the sows farrowed in portable houses in fresh runs.

To correct any of the above defects, regulate the feeding of sow carefully. If treatment is required, try smearing sow's udder with a solution of citrate of iron. The following has also been used with benefit, viz. : Sulphate of iron, 3 drams ; sulphate of copper, 1 dram ; water, 1 pint. Dose : 1 teaspoonful.

Bacillus suipestifer Infection.—In the Waikato this has been the disease most often present where numbers of pigs were dying. It is essentially a dirt disease and may cause considerable loss where pigs are kept under insanitary conditions The organism is evidently a common one round old yards and sties, and may be present in normal pigs. It has considerable powers of resistance. The disease is occasionally met with where pigs are under good and clean conditions, but only one or two deaths will occur. The organism becomes harmful only when the pig's resistance is first lowered by other factors such as unbalanced feeding, sudden lowering of temperature due to change in weather or exposure, journeys to or from sales, consequent changes in diet, &c Dirt is an important factor, playing a part in accumulating numbers of the germs, and distributing them from pig to pig via feeding-troughs, as infection probably takes place chiefly by swallowing the organisms in dirty food. The young pig is the chief sufferer either the sucker or more often the young weaner from eight to twelve weeks. In the United States of America the disease is believed to be the chief cause of loss amongst pigs about this age.

The symptoms vary considerably in different animals and in different outbreaks. For descriptive purposes we may divide them as relating to (1) the chest ; and (2) the digestive tract ; though any combination may be found. In the first class, pneumonia is very frequent. Probably the majority of lung cases in pigs is due to this cause. Affected pigs usually show breathing somewhat hurried with a jerking movement of the flanks ; there is some nasal discharge and usually a cough ; condition is lost fairly rapidly. Appetite may be retained, and, among a large mob, the earlier symptoms may be overlooked. Then the pig is reported to have died suddenly, but a post-mortem examination will show that pneumonia has been present for some days. At other times the acute symptoms subside, but the pig continues unthrifty and stunted, and may die at any time from heart weakness. In other cases recovery may be apparently complete. Where the digestive organs are affected, which seems to happen more often in outbreaks amongst the younger pigs—suckers or pigs recently weaned — there is usually diarrhœa, condition is lost even more rapidly and death in suckers may follow quickly. Appetite is very capricious and food may be refused. On examining a pig dead from this disease, the skin of ears, belly, and inside thighs may be seen to

be dark-red or purplish, due to weakened circulation. On opening it, the lungs are frequently found to be more or less solid and adhering to ribs—pleurisy. The sac containing heart is frequently distended with fluid, or may adhere to heart. The stomach lining is very frequently inflamed in patches. If the bowels have been involved, the wall of the large gut will be thickened with ulcers on membranes on inner surface. This form is referred to as necrotic enteritis.

Attempts at treatment are less important than preventive measures. However, affected pigs should be separated from the rest so that they will be undisturbed, provided with bedding, and allowed a diet of whole milk, molasses, and lime water. Where scouring is noted, as in suckers, results have been obtained from small teaspoonful doses of 2 drams sulphate of iron and 1 dram bluestone in a pint of water. As a practical measure it is better to remove the apparently healthy pigs from the pen into a clean run. The feeding must be adequate; cod-liver oil, ½ oz per pig, may be added for a week, together with bone-meal and a little citrate of iron solution, but cleanliness is most essential. Any chronic cases which are unduly stunted, or in which the respiratory symptoms persist, should be destroyed, as they are unprofitable to rear and are a source of infection to others. If the yards have been in use for a number of years, or are dirty, this disease, once it gets a foothold, is likely to cause considerable loss year after year and either a new location must be found for pig-runs which is advisable, or at least all affected runs should be broken up and spelled from pigs for a season by growing a root crop on them

Pasteurellosis.—This is sometimes called infectious pneumonia, since pneumonia is a common but not constant feature It is also known as swine plague. The cause is an organism which becomes active mainly as a result of some sudden lowering of vitality. Recent experience suggests that this disease is more likely to occur as an outbreak following the introduction of new pigs. Exposure at sales, transport, and irregular feeding and change of diet, reduces the powers of resistance in these pigs and the organism is enabled to set up disease; at the same time its virulence is apparently increased, and infection may be carried to, and disease set up, in previously healthy pigs coming in contact with the new ones. The importance of isolating new purchases for about ten days is thus seen.

In acute cases fever with high temperature and marked depression may be noted only a short time before death occurs. More often symptoms of pneumonia are seen—hurried breathing, &c., with depression. Examination of a pig dead of this disease may show very little if in the acute stage; probably solid areas of lung if in a later stage. To determine the presence of this trouble with certainty material must be submitted to the Veterinary Laboratory at Wallaceville. The history may be suggestive—namely, an outbreak following the introduction of fresh pigs, also the fact that somewhat older pigs and even sows may be attacked.

Treatment of affected pigs should be along lines suggested for suipestifer infection—isolation of affected, attention to comfort, and laxative feeding, no disturbing unnecessarily. The disease may occur under quite good conditions of management.

Necrotic dermatitis.—This involves ulcers, septic sores, &c., and is sometimes, though incorrectly, called "lupus." It is a repulsive condition and is all too common; it is the result of the infection of

small wounds by one or both of two organisms. One is the bacillus *Necrophorus*, a common contaminant of old yards, &c., and the cause of "foul-in-the-foot" in cows, black pox, calf diphtheria. The action of these, the first in particular, is to cause death of the surrounding tissue by the powerful toxins which they form, and thus there results a mass of dead tissue the extent of which constantly increases. While necrotic dermatitis is largely a dirt disease, commoner in old or filthy and contaminated yards, there seems little doubt that it may be set up occasionally in quite clean surroundings, and this chiefly by the introduction of already infected pigs. Direct contact with such a sore by any small wound on a healthy pig is liable to infect the latter, though by far the commonest way of infection is the contamination of wounds by mud and dirt containing the organism. Two factors are thus usually found to play a part in outbreaks: (1) Presence of the organism either in affected pigs, or, as usually seen, in dirty yards; (2) something leading to occurrence of small wounds, such as (*a*) excessive barbed wire in runs which is a fertile cause, and probably accounts for many cases about the face or shoulder; (*b*) overcrowding at feeding-time resulting in treads, &c., and probably responsible for many of the cases about the feet and pastern; (*c*) quarrelsome pigs biting their neighbours; (*d*) castration wounds; (*e*) teething—the four middle teeth come through the gum at the age of three to eight weeks, and this break in the gum is possibly the point of entry in some cases affecting the gums and lips of small pigs

The symptoms are unmistakable. In some cases there is a small tumour-like swelling with a small wound, and, if open, this swelling is found to contain broken-down evil-smelling tissue, mingled with blood clots. In most cases there is a more or less extensive sore or ulcer, with raised edges but eating deeply into the underlying tissue; if scraped it is found to be lined with greyish toughly adherent tissue with a vile odour of decay. Such lesions may occur in any part as on the forehead extending into bone, around eye, inside the lip or eating away lower lip and interfering with feeding; on shoulder, side, or quarter; on knee, hock of pastern causing severe lameness, or in scrotum, as a result of infected castration wound—there they cause a large fibrous tumour with a necrotic centre and fistulous opening. Where feeding or locomotion is not interfered with, general health is unaffected.

Quite good results have frequently but not always been obtained from one or other of the following measures: (1) Isolation of all affected, again preferably by removing apparently healthy to clean quarters; (2) destruction of seriously lame or extensively affected; (3) thorough cleaning of sores, using good strong spray pump and any mild antiseptic solution (Condys), and scraping off scabs and dead tissue; (4) dressing with tincture of iodine and methylated spirits equal parts, bluestone solution, 4 oz. to a quart, hydrogen peroxide, or arsenical cattle-dip in 1–50 solution. The poisonous dressings should not be used about mouth. In case of scrotal swellings, these will sometimes recede if opened deeply and dressed with iodine.

Control is most important as the disease is largely preventable and is difficult to treat. It causes considerable economic loss—sometimes quite big pigs are attacked, and rendered useless for meat purposes, as many carcasses are condemned outright or partly, particularly

where the disease has attacked the scrotum. Barbed wire should be used as little as possible, at least for internal subdivisions. Overcrowding at feeding-places should be avoided. Pigs when castrated should be clean, and immediately after the operation should be moved and confined to thoroughly clean quarters for at least a fortnight, either a clean grass run or a scrupulously clean and bedded sty. Where such precautions are neglected, it is not uncommon to see every pig that has been castrated develop these lesions to some degree.

Mange.—This is an infectious disease due to the presence in the skin of a tiny almost microscopic mite. The female burrows in the skin to lay her eggs. An intense itch is set up. The disease has been mistaken for sunburn or for eczema of dietetic origin. The parasite will not live very long apart from the pig. As a rule, the disease has been seen following introduction of fresh pigs, but some outbreaks of it have developed through its presence in a sow in a mild and unrecognized chronic stage, over some considerable period.

The chief symptom is the intense itch, greater than that caused by lice. The disease commonly appears behind the ears, spreading along the back and sides, the skin shows minute red spots ; later a dry thick crust rises, and the skin itself becomes thickened and hairless ; the constant rubbing aggravates the lesion ; in young pigs growth stops ; condition is lost and some deaths may result of other diseases gaining a footing.

Thorough oiling with waste oil, or crude fuel oil, twice at intervals of a week, will cure most cases and a marked improvement in general condition frequently results. All contacts should also be treated, and where a considerable number of pigs is involved dipping is the most convenient method of treatment, the dip containing a layer of oil floating on water, or an antiseptic solution. Some breeders make a practice of dipping all purchased pigs, and believe that besides preventing the introduction of skin-parasites, it helps to protect against other infections. Suspected cases should be reported to the nearest Inspector of Stock, who will advise as to treatment. It is an offence to expose for sale pigs affected with this disease.

Lice and Fleas.—These cause considerable irritation, and if present in numbers must impair vitality. Lice are readily controlled by regular oiling, and the pigs may be allowed to carry this out themselves, if a rubbing post is provided, wrapped round wih sacking which is kept soaked with waste engine oil or whale oil. Fleas may be dealt with by a 1 to 4 mixture of kerosene and oil, but houses must be cleaned out and sprayed to get rid of the larval forms, and in sandy runs during the summer eradication of fleas may be very difficult.

Paralysis—Trouble is sometimes experienced with pigs otherwise apparently healthy and often fat, which either stagger or sway about on hind feet, drop at the hocks, or are completely unable to support any weight with the hind limbs, which are trailed behind them. While sometimes seen in weaners, the condition is more often met in pigs about four months old, and occasionally in sows or boars. As pointed out by Seddon and Fraser, it is not a true paralysis, since there is still power of movement in the limbs. These writers also drew attention to a peculiar "falsetto squeal," characteristic of

affected pigs. The cause is not known definitely. Seddon and Fraser considered that it was not dietetic in origin. One is inclined to think, however, that it is related in some way to mineral metabolism, as some cases apparently show defects in the "mineralization" of the bones. A calcium deficiency might be suspected, but usually abundant milk is being fed, which should contain ample lime. There may, however, be failure to utilize this due to lack of vitamin D, which is largely removed from the milk in separating. Our experience has been that cases have been most frequent on peaty lands, and that skim-milk in abundance without supplement, has been fed Investigation of this condition is in progress.

Treatment is very uncertain. Whilst in some cases a change of diet and the addition of lime, cod-liver oil, and iodine have been followed by recovery, in other cases these measures have failed. Attempts to prevent the condition have also been of doubtful value. The best advice one can offer is, where the trouble appears, to try the above variations in the diet, and where there is chance of more of the line becoming affected to quit them as porkers since the carcass is quite suitable for use.

The above disease should not be confused with a type of sudden lameness and soreness, with unwillingness to rise, sometimes seen in young pigs which squeal if handled, and which may show general symptoms of fever and illness not seen in "paralysis" This is a type of joint infection, and the hocks are sometimes visibly swollen. Death may follow after one or two days. Sudden chills and damp conditions are responsible for most cases.

Internal Parasites.—So far these are not of great importance here, but under the practice of using the same runs for pigs year after year ascarid infection, if once introduced, has every opportunity of becoming established and widely distributed. The ascaris is the common large white worm, the adult reaching to a foot in length, pointed at both ends. It is present in the small gut behind the stomach, but most damage is done by the larval forms which hatch from eggs after they are swallowed, and which bore through the tissues, chiefly lungs, setting up a form of pneumonia. Good sanitation, clean yards, and periodic changes of the runs on to clean country should keep this parasite in check.

The small red stomach-worm has occasionally been responsible for the deaths of mature pigs, principally sows. The lining of the stomach is found to be much thickened and roughened with many of the hair-line worms present.

Unthriftiness and deaths in young pigs has occasionally been found due to presence of large numbers, in the hydatid stage, of one of the tape-worms of the dog. These small bladders are found scattered through the belly cavity, and the liver is extensively damaged by their migrations through this organ. Their presence points to contamination of pigs' food—probably grazing—by dogs' excreta.

Tuberculosis.—While tuberculosis is the chief cause of condemnation of pig carcasses in meat-works, it is not usually given much thought by the pig-farmer, as clinical signs are rarely shown by affected pigs. Swelling of the glands at the throat, or, in sows, a chronic cough, or a chronic enlargement of one or more sections of mammary gland or

an unthriftiness should be regarded as suspicious. While one has seen an infected sow with a litter showing clinical signs of the disease, apparently contracted from the mother, most cases are due to the milk of infected cows, and any undue number of condemnations in farm pigs should call for careful scrutiny of the dairy herd. However, until efficient and universal pasteurization of all dairy by-products fed to pigs is adopted, or elimination of tuberculosis from dairy herds is brought about universal use of the tuberculin test, condemnations of pig carcasses for tuberculosis are not likely to diminish.

It may be noticed that in the United States of America a proportion of tuberculosis in pigs has been found to be due to the avian type of organism, infection being from poultry. This has not so far been found in pigs in New Zealand, though tuberculosis in poultry is common.

THE CLEANING OF MILKING-MACHINES.

J. W. Smith, Dairy Division.

The cleaning of milking-machines by what is now commonly termed "the boiling-water and caustic-soda method" has been extensively practised for a number of years, and has stood the test of time. No other known method has proved so satisfactory with respect to sanitary efficiency combined with simplicity, speed, and cheapness in operation.

The Layout of the Milking-machine.

The more compact the layout of the machine the greater the ease in cleaning. Various types of machines are in use, and of these "the releaser and vacuum-tank" type is the most common. A few comments about the layout of this type of machine will serve to indicate how the method of cleaning can be usually applied to the best advantage.

The main milk-pipe running through the shed should not be placed higher than is really necessary, and if possible should lead directly into the releaser without elevation. It should be well supported by brackets at distances close enough to prevent sagging and have a fall towards the releaser of at least 1 in. to each 7 ft. of length. The main vacuum pipe should have a similar fall towards the vacuum tank, as should the breather pipe from the pulsator to the releaser. The pulsation or air-pipes should be so installed as to have a fall towards the screwed end. Piping installed in this manner is easily accessible for cleaning, and effective draining is ensured.

The Rubberware Parts.

Rubberware of first-grade quality is the best and cheapest to use. Tubing and inflations, when new, possess a very smooth inside surface, and this condition can be maintained for a long period, provided the method of cleaning is properly carried out. Spiral brushes or metal scrapers should not be used for cleaning the inner surface of rubber tubing, as they cause scoring and roughening

of the surface, and create lodging-places for deposits of milk and germs, with disastrous results both to the rubber and the quality of the milk.

The accompanying illustrations emphasize the comparative effects on the rubbers, and demonstrate the good results obtainable by using the boiling-water and caustic-soda method of cleaning.

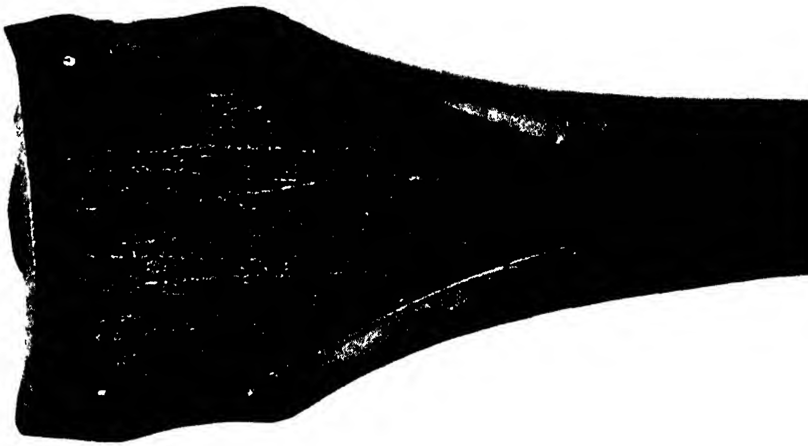

FIG. 1 LONG MILK-RUBBER AFTER TWELVE MONTHS' USE AND CLEANING DAILY WITH BOILING WATER, WASHING-SODA, AND THE USE OF A BRUSH AND SCRAPER. NOTE THE SCORED INNER SURFACE OF THE TUBE.

FIG. 2. END VIEW OF THE SAME RUBBER (FIG. 1). THE WHITISH INNER CIRCLE INDICATES THE SCORED SURFACE OF THE TUBE.

THE MATERIALS AND APPLIANCES REQUIRED.

The principal requirements are:—

(1) An adequate clean cold-water supply.

(2) Suitable means for providing sufficient boiling water for the cleaning of the machine after each use, such as a copper, steam-boiler, or an efficient electric heater.

(3) A metal bath or tub of suitable size, some large buckets, scrubbing-brushes, a ball of horse-hair or a small pipe-traveller hair brush, and an ample supply of caustic soda.

(4) A dairy thermometer registering to 212° F. or a few degrees over.

For cleaning cans, separator parts, &c., a supply of washing-soda should be provided.

FIG. 3 CLAW-TUBE RUBBER FROM THE SAME MACHINE AS MILK-TUBE IN FIGS 1 AND 2. THE INDENTATIONS INDICATE EFFECT OF LODGMENT OF GREASE.

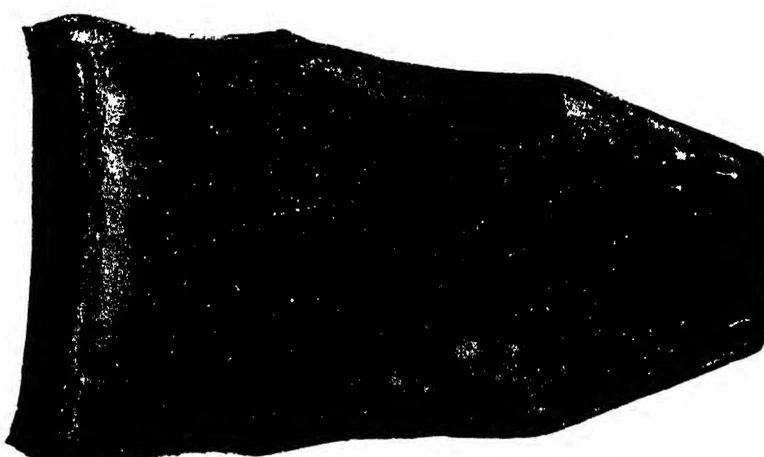

FIG. 4. ORDINARY TEAT-CUP SOFT INFLATION AFTER THREE MONTHS' USE, SHOWING THE EFFECTS OF BRUSHING.

Strength of the Boiling-water Caustic-soda Solution.

The correct strength of the solution to use is one full teaspoon of caustic soda to each four gallons of boiling water. If this strength is adhered to, and its use immediately followed by rinsing out with at least double the quantity of clean boiling water, no harm will come to the rubber or other parts of the plant.

Application of the Boiling-water and Caustic-soda Method.

The procedure is as follows :—

(1) After starting the machine, and before commencing to milk, draw some clean cold water through each set of teat-cups, taking care that the water does not run into the milk vat or cans. This rinsing with cold water prevents adhesion of milk to the piping.

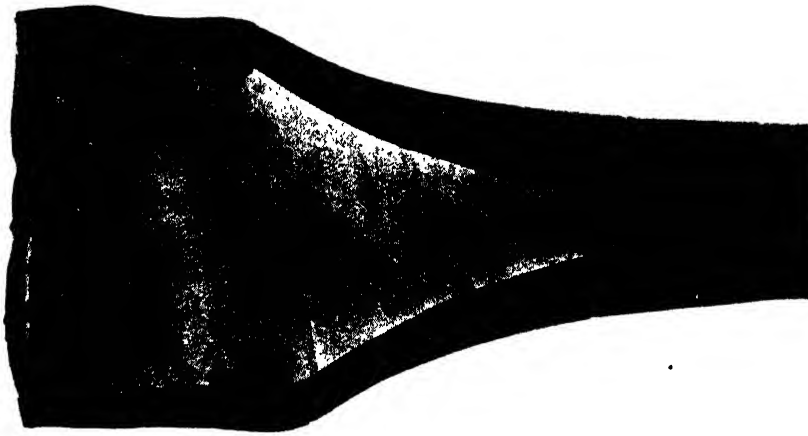

FIG. 5. LONG MILK-RUBBER AFTER TWO SEASONS' USE AND CLEANING DAILY BY THE BOILING-WATER AND CAUSTIC-SODA METHOD.

FIG. 6. END VIEW OF THE SAME RUBBER (FIG. 5).

(2) Immediately after milking and before applying the boiling caustic-soda solution, draw some cold water through each set of teat-cups, in order to rinse out any milk remaining in the system. Failure to use cold water before the application of the boiling caustic-soda solution will result in the gradual formation in the milk-passages of a hard scale, commonly called " milkstone."

(3) Wash off all dirt from the outsides of the teat-cups and rubber tubing with a solution of warm water and caustic soda, and well rinse with hot water.

(4) Put the releaser out of milking action by stopping the pulsator at a point that will cause the outside flap of the releaser to seat tight. Then draw through each separate set of teat-cups at least one gallon of the boiling caustic-soda solution. On drawing it

FIG 7. CLAW-TUBE RUBBER FROM THE SAME MACHINE AS MILK-TUBE IN FIG 5.

FIG 8. ORDINARY TEAT-CUP SOFT INFLATION AFTER FOUR MONTHS' USE AND CLEANING BY THE BOILING-WATER AND CAUSTIC-SODA METHOD.

through the set farthest from the releaser, carefully lift the flap or plug of the end of the main milk-pipe and insert a 6 in. length of plaited horse-hair or the pipe-traveller brush, retaining hold of same until the vacuum pressure again rises, and simultaneously remove the plug for a moment and allow the horse-hair or brush to whisk into the releaser. The releaser becomes full, and the overflow travels into the vacuum-tank. Next, place an empty bucket

under the releaser, break the vacuum by removing the plug from the end of the milk-pipe, and the contents of the releaser discharge into the bucket. Then replace the pipe-plug.

(5) To remove all traces of the soda solution, immediately draw through each set of teat-cups at least two gallons of clean boiling water. Both the soda solution and boiling water are applied with the best results by dousing the cups in and out of the liquid, about three-quarters of the time in and one-quarter of the time out. The resultant inrush of air quickens the flow of the liquid, and causes it to surge with a scouring action through the piping. The quantities of the boiling liquids should be sufficient to fill the system and overflow the releaser by,

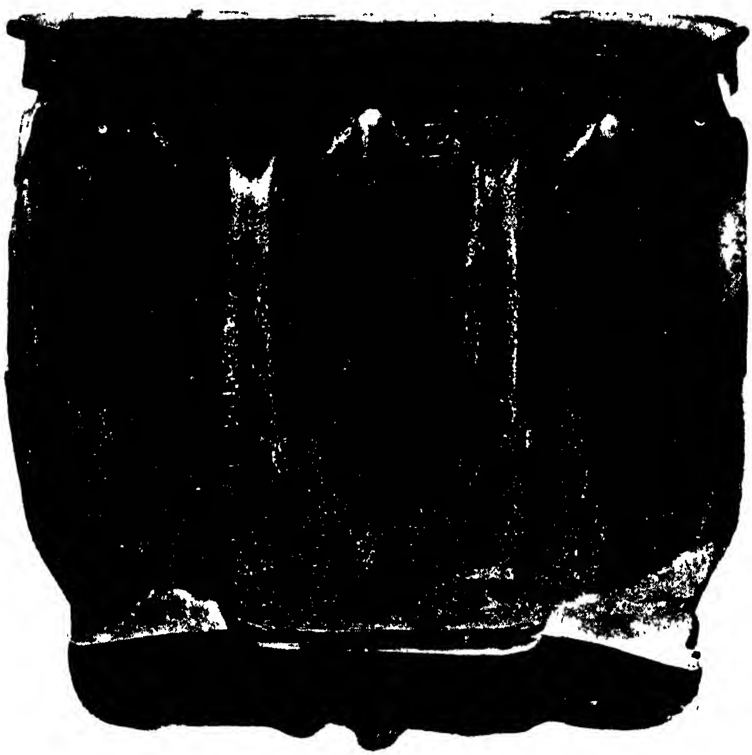

FIG. 9. A GROOVED HARD TEAT-CUP INFLATION AFTER TWELVE MONTHS' USE AND CLEANING BY THE SAME METHOD. CAPABLE OF THREE MONTHS' FURTHER USE.

at least, one gallon, thus cleaning the pipe between the releaser and vacuum tank. In addition, as a result of stopping the pulsator, the hot water is retained in the system, which thereby is heated to a maximum heating temperature. The vacuum and air system should next be cleaned.

(6) Detach the air rubber tubing from each claw and place the ends in boiling caustic-soda solution, and draw up at least a quart through each, then rinse with clean boiling water. The water will pass through the tubing under the pulsator-slide and into the main vacuum pipe and into the vacuum tank.

(7) Next detach the air-pipe from the rubber tube connecting it to the outer chamber of the releaser, and draw through about a quart or more of the boiling soda solution, and then some clean boiling water. These fluids will also travel to the vacuum tank. The cleaning to this stage is as much as need be done under vacuum.

(8) Before stopping the machine, allow the teat-cups and all air-pipes to draw air for a few moments. Remove and replace the plug on the main milk-pipe two or three times to cause an inrush of air to carry away all surface moisture and to leave the machine dry and sweet.

(9) Leave all taps and ends open to allow of the free circulation of air, then stop the machine.

(10) Next scrub and scald the vacuum tank.

(11) Dismantle the releaser and scrub and scald it.

(12) Disconnect the teat-cups and rubbers from the milk and air pipes and place them in a dry airy clean place protected from dust and the rays of the sun.

It is essential that the temperature of the hot water used be not less than 200° F. and preferably boiling—*i.e.*, 212° F. A thermometer should be used to check the temperature. Too little boiling water is often used, but rarely too much.

To produce milk of good hygienic quality, milking-machines should be regularly cleaned as outlined each time after use. With practice, the average machine can be cleaned in about twenty minutes.

MILKSTONE.

If a milking-machine is not regularly flushed with cold water to remove all traces of milk prior to treating with hot cleaning solution or steam, a hard deposit readily forms inside the pipes. This "milkstone," as it is called, enables germs to multiply, and special steps must be taken to get rid of it. The simplest method is to use a weak solution of spirits of salts (hydrochloric acid), promptly followed by liberal rinsing with hot-water soda solution. The procedure is to dismantle the piping and prepare a solution of spirits of salts in the proportion of one part of spirits to three of water. In some cases a stronger solution may be required. To each 7 ft. length of piping use 8 oz., or about a breakfastcupful. Plug one end of the pipe, pour in the solution, then plug the other end. Allow the solution to remain in the pipe for about thirty minutes, revolving the pipe occasionally to ensure distribution of the solution so as to soften the scale. Remove the plugs and clean the pipe with hot washing-soda solution and a tight-fitting hard brush; then rinse with clean boiling water. This treatment, properly applied, will leave the surface clean and bright.

Figs. Nos. 10 and 11 are illustrations of half-sections of a length of pipe before and after treatment by this method.

STEAM STERILIZATION OF MILKING-MACHINES AND DAIRY UTENSILS.

The "boiling-water and caustic-soda method" of cleaning, properly applied, leaves the milking-machine in a satisfactory sanitary condition. A further improvement is still possible by

FIG. 10. HALF-SECTION OF MAIN MILK-PIPE AFFECTED WITH MILKSTONE.

FIG 11. HALF-SECTION OF SIMILAR PIPE AFTER TREATMENT.

afterwards subjecting the inside parts of the machine to low-pressure steam for about five minutes to effect sterilization.

Steaming alone will do harm rather than good, since, if the machine and utensils are not first thoroughly cleaned to remove all traces of milk, the application of steam (or even boiling water) not preceded by flushing with cold water will have the effect of causing hard deposits of milkstone to form in the machine. Such deposits accumulate from day to day and harbour countless millions of bacteria which resist prolonged efforts to destroy them. It should not be thought that the use of steam alone provides a short-cut to cleaning a machine. Proper cleaning with cold water, boiling caustic-soda solution, and boiling water should be carried out before steaming. Sterilization with steam provides the finishing touch, and is the best possible safeguard for quality.

For sterilizing dairy utensils steam may be generated in a small pressure boiler, which can also be used to provide ample hot water. Such pressure boilers have the advantage of possessing ample reserve of pressure to force the steam to the farthest end of the milking-machine pipes. During the last few years a variety of heating plants have been designed to provide readily an ample supply of both boiling water and steam by burning rapidly wood, coal, &c

Even when machines are in the best sanitary condition, the milk may be seriously contaminated through coming into contact with other equipment, coolers, cans, &c, which, although well washed, have not been sterilized. Consequently, these should also be thoroughly steamed. Cans are treated most effectively by inverting them over a steam jet. The cooler may prove difficult to sterilize unless it is of such a size that it can be placed inside a suitable can or tank. After detaching from the water-supply to wash it thoroughly, the cooler can be sterilized by connecting a steam-hose to where the water runs in. In cases where a small tank is used as a steam-chest, care must be taken that steam is turned on long enough to ensure the whole contents being adequately treated. To ascertain this, a thermometer should be inserted as near as possible to the bottom of the tank, on the opposite end from the steam inlet, and the flow of steam should be kept up for five minutes at least after 210° F. is registered.

THE USE OF DISINFECTING-COMPOUNDS.

It is many years since the first attempts were made to minimize contamination of the milk by washing cows' udders with coal-tar disinfectants and similar carbolic fluids or with solutions of chloride of lime. Traces of these disinfectants inevitably reached the milk and produced off-flavours.

A satisfactory material for use upon udders is a dilute solution of Condy's crystals (permanganate of potash), which has no odour. Sufficient should be used to colour the water a deep pink (avoid making it a dark red), and when the pink disappears it is time to obtain clean water and use more crystals.

In recent years the desire to improve the cleanliness of milking-machines has provided the opportunity for persuading farmers to

use various chemical disinfectants, particularly those having a chlorine basis, such as bleaching-powder or chloride of lime, hypochlorites, &c. It has been noticed repeatedly that whenever these compounds are used in connection with the cleaning of milking-machines, cans, &c., excessive amounts inevitably find their way into the milk and cream. Cases have been observed where suppliers were getting the highest grade regularly for their milk or cream and suddenly changed to second grade. Upon investigation it was found that some chemical sterilizing-solution had been used. When the use of this was discontinued, the grade returned to the previous high standard. Metals, especially in parts of a milking-machine, are very readily corroded by strong chlorine solutions. The use of these compounds for the cleaning or sterilization of milking-machines, cans, &c., should be avoided.

THE MISUSE OF LIME, WITH SPECIAL REFERENCE TO BUSH-SICK LANDS.

B. C. ASTON, Chief Chemist, Department of Agriculture.

(Concluded.)

In a report from Mr. C. R. Taylor on the Whakamarama district, 7th February, 1934, he states: " . . . In quite a number of instances evidence was not lacking to show that lime had reacted to the user's detriment, although one farmer thought that its moderate use had improved his pastures and made them more palatable to stock " Another settler at Tauranga a few years ago lost a number of stock after top-dressing with lime where previously he had carried them successfully.

In other countries experimenters have recorded the injurious effects of lime on sandy or light soil. Liechti and Truninger, *International Review of Agriculture*, 1927, page 429, determined the effect of carbonate of lime on sandy loam and loamy sand soils with results as follows (control equals 100): Oats, 80–94; clover, 76–93; lucerne, 75–91; potatoes, 79·7–93·7; spring barley, 90·7; beet, 55. The authors conclude that liming is unsuitable for sandy soils.

Lipman, Blair, and Prince, *International Review of Agriculture*, 1926, page 546, state: "The effect of liming on the potash content of the soil and corn-stalks was determined. The lime was used in conjunction with twenty different fertilizer treatments including green manures and potash salts, with the following average results:—

Percentage of potash in—	Limed.	Unlimed.
Soils..	1·088	1·364
Subsoils	1·233	1·417
Corn-stalks	1·972	2·343
Potash in corn-stalks in pounds per acre	67·16	63·54 "

All the individual figures showed the same trend.

Sir John Russell, *Journal of Royal Agricultural Society of England*, 1919, page 95, on the reclamation of waste land, states: "The

conditions of a light sandy soil tend to shorten the life of the plant . . . Lime is needed but the low quantity of organic matter is a warning that great care must be exercised, otherwise loss is the result."

Liechti and Truninger, *International Review of Agriculture*, 1921, page 315, in pot experiments with a sandy clay soil poor in lime, using flax as the experimental plant, found that lime had a retarding effect on flowering in proportion to the amount used, and the largest amount of lime prevented fructification and induced apical necrosis.

Gile and Carrero, *Journal of Agricultural Research*, 1920, Vol. 20, page 33, dealing with lime-induced chlorosis in plants state that all calcareous soils do not induce chlorosis, and the authors believe it is not calcium carbonate itself that causes chlorosis, but some condition associated with the presence of carbonate of lime. The weight of evidence points to a deficiency of iron in the ash as being one cause of the chlorosis, with possibly an excess of lime as a contributory cause. Work in water cultures with rice seems to show definitely that the alkalinity of carbonate of lime is not directly injurious to this calcifugous plant, nor is the alkalinity in itself a cause of chlorosis.

De Angelis d'Ossat, *International Review of Agriculture*, 1921, page 156, dealing with the action of iron and manganese in soils and plants and chlorosis caused by excess of manganese, suggests that the iron manganese balance rather than their presence or availability is what is disturbed by excess of lime.

Shaw, *Experiment Station Record*, 1932, Vol. 67, page 250, records that on a sandy loam soil liming actually decreased the growth of apple-trees, except where potash was also applied.

Tacke, *Experiment Station Record*, 1914, Vol. 31, page 726, says that excessive liming on moor and sandy soils has an unfavourable effect, and on such soils poor in lime liming has a very lasting effect, and should only be done when the necessity for it is indicated by comparative tests.

Hall and Russell, "*Agriculture and Soils of Kent, Surrey, and Sussex*," referring to the Bagshot sands say: " . . . The soil has remained heath and common simply because it has always been too poor to be worth enclosing and cultivating. Only near the bottoms of the valleys or on certain areas where the soil is not so light as usual has cultivation sprung up, but thanks to the liberal use of London dung, street refuse, and the like, the barren sands have in many cases been transformed into useful land especially for market-garden purposes. The soil is entirely sand and is entirely lacking in lime, the carbonate of lime figures ranging from nil (two soils), 0·01 (three soils), 0·27 (one soil), and 0·4 (one soil). Manuring has so far been confined to dung, but the authors recommend chalk or lime in the early spring before the land is broken up, and also neutral phosphates (guano or bone-flour) and sulphate of potash, and sodium nitrate. Manuring should only just precede sowing. Where land is regularly hayed 1 ton lime and 10 to 15 tons farmyard manure every five years. Sandy soils are only used for hops when well supplied with ground water and large quantities of dung can be applied. The hop plant has no special need for lime. On heavy calcareous soils all fruit-trees seem to suffer and are liable to become chlorotic. On the light sandy formations the soil is too open

and too devoid of carbonate of lime to be worth cultivating. It must be chalked and clayed, and even then is of little value in exposed places. These soils are rarely found in cultivation, except where great quantities of stable manure are available. The wash from the Bagshot beds responds in a marked degree to lime in some places (Weybridge, Surrey), but at others it requires considerable dressings of dung."

It will be noted that these soils are mainly for cropping for market-garden purposes, and not for the pasturage of stock. Liming is only permissible when added with large quantities of farmyard manure or London dung or clay For an account of the injurious effect of carbonate of lime in large quantities, see "Soil Conditions and Plant Growth," 1932, page 122, by Sir John Russell.

Gile, Porto Rico Agricultural Experiment Station Bull. 11, 1911, records that pineapple chlorosis occurs on soils containing much carbonate of lime, while soils on which plants recovered contained little lime and no carbonate of lime.

Hendrick and Ogg record in *Journal of Agricultural Science*, Vol. 7, 1916, page 458, that Scottish drift soil at Craibstone was of a coarse sandy nature with less than 5 per cent. of clay, but comparatively rich in organic matter and total and available phosphate and potash. It had a high lime requirement and contained no lime, but had grown good crops for many years without the application of lime.

Robinson and Rice-Williams, Faraday Society, 1924, page 593, state: ". . . From studies of Welsh soils containing small quantities of clay and large amounts of organic matter, it appears that unsaturation—that is, the presence of free aluminosilicic and humic acids—is not inconsistent with fertility, and that many soils in this condition do not respond to lime."

W. M. Davies, *Journal of Royal Agricultural Society of England*, 1932, page 21, states that on sandy soils with high humus content, liming may give rise to "grey spot" in oats which is due to inability of the plant to obtain sufficient manganese. Solid sulphate of manganese ($MnSO_4$) and basic slag proved the most effective cures. Solutions of iron salts had no effect. Iron chlorosis is also referred to and the statement made that heavy liming tends to favour attack by some fungous diseases—*e.g.*, potato scab. On the other hand, liming of course mitigates clubroot.

An English official publication "Research and the Land," Wilkins, 1927, Ministry of Agriculture and Fisheries, London, in a most interesting chapter on soil sourness, mentions the fact that many soils in Scotland, North Wales, and Ulster rich in exchangeable bases show little lime starvation though so deficient in calcium. The little-weathered Scottish soils with their great reserves of basic plant-foods can be frequently manured with ammonium sulphate with no risk of inducing acidity, and the soils rarely show extreme lime hunger as English soils do when treated with frequent applications of ammonium sulphate. The case of North Ireland is very similar. In that country numerous soil-samples have been examined in connection with field-experiment trials, and in only one case did the soil contain calcium carbonate; thus the area is largely devoid of lime in the ordinary sense of the word, but there is not a lime shortage as we understood, for the soils

are richly supplied with other bases and the preliminary liming experiments that have been carried out in the area show, so far, no marked beneficial results from liming. The same thing applies to North Wales, where many of the most fertile soils contain no calcium carbonate and the application of lime has no effect on the crop, even though the soils show much lime hunger by recognized methods of testing.

The coarse pumice soils of the North Island volcanic plateau of New Zealand are also composed of particles which have not been weathered down to the extent found in ordinary fertile soils, and thus are similar in their lack of response to lime to the soils of Scotland, Wales, and Ireland mentioned above. The particles of the pumice soils are composed of a volcanic froth, in most cases deposited by air-currents. The soil therefore, from the manner of its deposition from air, is extraordinarily light. A cubic foot of moist soil may weigh only 68 lb. whereas the better-class and more weathered soils of the district which are free from bush sickness may weigh 86 lb. Although sandy in texture the pumice soils are composed of silicates of the metals rather than a pure silica (quartz), and contain large reserves of metals, particularly potassium, sodium, calcium, magnesium, and aluminium, which are combined with silica, and only become weathered or oxidized and available to plants extremely slowly. Owing to the iron and manganese having been largely leached out, the soils are light in colour. A recent report from Mr. C. R. Taylor, Analyst's Assistant at Rotorua, states that from inquiries he has made he finds that lime alone applied as a top-dressing for pumice soils produces a pasture more unpalatable and drier in appearance than that on the (untreated) control plot, while, generally speaking, lime and superphosphate mixture give an inferior result to that from superphosphate applied alone. Smallfield ("Pasture Establishment on Pumice Lands," this *Journal*, December, 1933, page 354) states. "Pumice land shows a marked response to phosphatic and nitrogenous fertilizers, potash and lime give little or no visible response."

Danger in Licks.

In addition to the danger of applying lime (burnt or unburnt) to pastures on bush-sick soils, in the giving of mineral foods to stock with salt as a lick it is inadvisable to use lime in either of those forms, and this is a warning which is applicable to farms both in and outside the bush-sick area. The difficulty of controlling the amount of lick which any one animal may take from a lick-box makes it difficult to prevent overdosage of any one ingredient.

Charles Crowther in "The Feeding of Live-stock" (*Jour. Roy. Ag. Soc., England*, 1933, Vol. 94, pp. 268–309) states:—

"From recent work at the Rowett Institute (J. P. McGowan, *Bioch. Journal*, Vol. 27, p. 934) it would appear that the most important single factor controlling the absorption of calcium and phosphorus is the acidity of the gastric juices. An excess of calcium in the diet, by neutralizing the hydrochloric acid of the juice, precipitates the phosphorus as tricalcic phosphate, whereby the assimilation of phosphorus is lowered. In view of the rather indiscriminate use of lime in various forms in present-day feeding practice, this observation is distinctly interesting, and finds support

in the evidence from practical feeding experiments that the supply of lime in rations beyond a certain proportion, which is quite low, may be definitely injurious."

The practical application of this work to New Zealand conditions where the control of lick to stock is very much more difficult than it is in England is that extreme care should be exercised in adding any alkaline compound to licks intended for automatical ingestion by the animal from troughs or lick receptacles in paddock, hillside, or dairy-shed. For some time past the writer has endeavoured to press this view on those whose business it is to manufacture licks for the farmer or to the farmer who makes up his own materials. It is now repeated that it is undesirable to include quicklime, slaked lime, carbonate of lime, carbonate of soda, or any alkaline material in the manufacture of stock-licks intended for ruminants.

The subject of the administration of mineral foods to domestic stock pastured on the great grazing countries is a most interesting one, opening up a wide field for investigation and discussion. In the drier countries of the world where it is not practicable to top-dress pastures, the giving of calcium phosphate licks has been systematized for many years; but in New Zealand, although rock-salt and agricultural salt has been used extensively, the giving of compound licks containing such minerals as phosphates, iron salts, iodine salts, calcium, and magnesic salts is a development of comparatively recent date.

In the early days of the bush-sickness investigation, over twenty years ago, many long-continued experiments, extending over many months and even years, were carried out to decide the best method of giving mineral foods thought to be deficient in the pasture and soil. Some of the results were so hopeful and the animals after a year's treatment appeared so healthy and normal in their growth and development that one might have been pardoned for supposing that the problem of a cure for bush-sickness had been solved. A further year's trials carried on and supplemented by additional experimental animals proved that no permanent cure could be effected in the particular manner which appeared so hopeful after twelve months' work. These experiments were an endeavour to keep stock healthy by giving superphosphate (monocalcium phosphate) in the drinking-water while the animal was confined to a pasture which had never been top-dressed with phosphate or any other fertilizer except that incidental to the natural grazing of stock on the paddock, which was a surface-sown pasture still in stumps. These results, which had aroused the highest hopes of the veterinarians and chemists in charge, dealt with a steer and a heifer and subsequently with calves. Although no permanent cure could be effected in this way, the experiments proved valuable in showing that by this simple and cheap way certain stock could be kept in health on sick pasture, the steer becoming fit for the butcher in a period which may have been impossible without medicated drinking-water. Probably, however, the most important lesson learned was that experiments with minerals on stock may give beneficial results for many months and yet prove to be illusive in effecting a cure in the end.

The preliminary good result may have been due to an unnatural stimulation of the cattle by repeated small doses of a mineral stimulant such as arsenic which was found to be present in the superphosphate to the extent of not more than 0·05 per cent., or it may have been due merely to the absorption of one of the other main constituents, phosphorus, calcium, or sulphur, instead of the minor impurity, arsenic. In an experiment in which the ruminants, sheep and heifer, were daily dosed with a copper solution the same wonderful stimulation was found to result, although this was not conducted on bush-sick country, but on healthy country where they had the usual supply of good pasture; and yet after more than a year of dosing these animals fell away in condition and some even died.

Other compounds are sometimes added to licks which, instead of injuring by deranging the animal's digestive functions, quickly kill it by acute poisoning. Twenty years ago a lick was put on the market which contained arsenic, a substance that in moderation is a great animal stimulant, and one which apparently enables animals to assimilate iron in forms such as the sulphate or chloride. (Those administered alone had been proved by lengthy experiments to be neither a preventive nor a cure for bush-sickness.) In this case with arsenic striking cures of mature cattle in the last stages of bush sickness were certified to by a committee of farmers, while the same committee found it ineffective on young stock. Certainly an official test killed a cattle beast which had free access to the arsenic-iron lick. This is an extreme case, but it shows the necessity for caution in the making of lick for stock under the conditions where the dosage per animal cannot be strictly controlled.

Summary.

Evidence is submitted to show that there is a danger in liming pastures on sandy soils, and that not only is the money so spent wasted, but that positive injury may result to the stock.

In the making of stock licks alkaline compounds such as lime or soda should not be used. Poisonous mineral stimulants such as arsenic should not be intentionally added. Commercial chemicals used in making licks may contain arsenic as an impurity in such small quantities that it may be useful.

The Instructor in Agriculture at Whangarei reports: "Certified perennial rye and certified white clover have been established successively by surface cultivation on rough country, swamp land, on the farm of Mr P Hill, Dargaville The areas dealt with during the past three years include about 25 acres of old paspalum pasture on rough hummocky swamp land, now well drained. A paddock of from 6 acres to 8 acres was taken in hand at a time. The lumps and hillocks were cut open with a double cut of the disks in September and October, and broke quite well in the summer. The disks were again used in late February and March to further cultivate the surface, and with a stroke or two of the harrows a good seed bed was acquired much earlier than was possible when the cultivation was left until the autumn. Ten pounds of certified perennial rye and from 1 lb. to 2 lb of white clover sown at the end of March with the top-dressing has given a good strike, and the sward in each paddock is now showing a good proportion of rye and white clover, while the mower can be used quite easily."

STRAIN INVESTIGATION IN WHITE CLOVER.

E. BRUCE LEVY, Agrostologist, and L. W. GORMAN, Assistant in Agrostology, Plant Research Station, Department of Agriculture, Palmerston North

PLOT trials of white clover in conjunction with type-testing for certification purposes have been continued at the Plant Research Station since the last report contained in this *Journal* for February, 1933, and some two thousand lines have now been subjected to trial. A part of this mass of material has now been finally analysed for type, and shows the following position in relation to certification (Table 1) :--

Table 1.—Showing Analysis of New Zealand White Clover Lots relative to Certification.

Number of Lines finalized.	Number up to Mother Seed Standard	Number up to Permanent Pasture Standard.	Number rejected for Certification.
997	126	378	493

The number of New Zealand lines rejected for certification is very large owing to the high standard set for New Zealand certified seeds. Most of New Zealand ordinary white clover which is not included in certification is of a relatively high standard compared with white clover of European origin, and its exclusion from certification come about through accepting only the very best types for certification purposes.

In the course of plot-testing for type, excellent opportunities are given for testing lines of authentic origin and for comparing the relative merits of one type against another. In the spring of 1932, 368 lines were sown, and yield weights of representative types of green herbage have been taken up to the present time. These yields are set out in Table 2.

Table 2.—Showing Production in Terms of Green Weights, and relative One Type to Another, of White Clover as Pure Swards, sown 19th September, 1932.

(Green weight in pounds per acre.)

—	Number of Plots	Summer Growth	Winter Growth	Spring and Summer Growth	Late Autumn Growth
		lb.	lb.	lb.	lb.
Station selection, Ac 2070 ..	3	18,600	5,350	39,300	5,110
New Zealand No. 1 ..	16	14,500	2,520	38,934	3,500
New Zealand No. 2 ..	28	12,050	1,620	31,126	1,040
Ordinary New Zealand ..	12	8,380	950	27,024	740
Kentish Wild White ..	7	6,790	662	25,420	510
Kentish once-grown in New Zealand	2	7,260	618	25,840	925
New Zealand Dutch ..	6	5,250	470	16,110	100
Imported Dutch	3	6,090	510	15,214	Nil
Morso	3	9,880	432	21,354	1,332
Ladino	2	13,920	3,742	24,284	1,020
Australian	5	6,750	790	27,679	333

Above Weights relative to New Zealand No. 1 (=100) at each Period

—	Summer Growth	Winter Growth	Spring and Summer Growth.	Late Autumn Growth.
Station selection, Ac 2070	128	211	101	147
New Zealand No 1	100	100	100	100
New Zealand No 2 .. .	83	64	80	29
Ordinary New Zealand ..	57	37	69	21
Kentish Wild White	47	26	65	15
Kentish once-grown in New Zealand ..	50	24	66	27
New Zealand Dutch	36	19	41	3
Imported Dutch	42	20	39	0
Morso	68	17	55	38
Ladino	96	147	62	29
Australian	47	32	71	10

These plots are very carefully sown, and all volunteer white is controlled so that the performance as measured is due entirely to the seed sown. These trials have not been conducted under grazing, and in this respect the results may be open to some criticism by the practical man. The great variation in yield as secured in these trials may not be secured in ordinary field practice where volunteer white is prevalent, and this is particularly true where the volunteer white is of a good or comparatively good type. Thus, if a New Zealand certified permanent pasture white clover were sown down in certain parts of Hawke's Bay or North Canterbury where the New Zealand No. 1 ecotype naturally predominates, there is every likelihood that the volunteer New Zealand No. 1 ecotype would take charge as far as the white clover population was concerned, owing to its more aggressive nature than the sown certified permanent pasture type, and this is true irrespective of what type of white clover were sown, unless it were a better New Zealand No. 1 type or a selected line of greater vigour than the volunteer white. Many farmers in New Zealand maintain that it does not pay to sow white clover because of its appearance in the sward from volunteer seed lying dormant in the ground This, in a measure, is true, and whether the action is justified depends upon what type of white clover volunteers. It can be said that on reasonably fertile, highly productive country there is a probability that the volunteer white is infinitely better than certain uncertified, open market white clover, and this would certainly be true if the open market seed were of European origin. Certification of the best types of white clover, and this will be particularly true when certified pedigree seed becomes available, puts an entirely different aspect on the matter, and, whereas the volunteer of the farm may have been better than open market seed, it can be taken in nine cases out of ten that certified seeds will give better results than will the volunteer of the farm.

In reviewing the results of the green weights of the various types as set out in Table 2, it is desired to stress two important differences: (1) The total green weight of the New Zealand No. 1 = certified mother seed class, and the Station selection from this type compared with all other types of white clover; (2) the long seasonal

growth range of the New Zealand No. 1 and selections ex this type. In the section of Table 2 giving relative weights, it will be seen that in the winter growth period—a critical time in pasture production—the New Zealand No. 1 was yielding from three to five times as much as the ordinary and imported strains, and the selections ex New Zealand No. 1 were in certain cases giving upwards of ten times the yield of clover at this date. If the period for late autumn is taken, a period when white clover tends rapidly to disappear as a pasture producer, the New Zealand No. 1 is again outstandingly ahead of the ordinary strains, and the Station selections ex New Zealand No. 1 type are again ahead of

FIG. 1. SOME WHITE CLOVER PLOTS IN THE SECOND YEAR OF TRIAL PHOTOGRAPHED 18TH MARCH, 1934, AND SHOWING SOME OUTSTANDING TYPE DIFFERENCES

In the foreground and mid-foreground New Zealand No 1 type is contrasted with ordinary New Zealand rejected for certification The run of plots in third traverse are all Station single-plant selections ex New Zealand No. 1 type. *[Photo, E. Bruce Levy.*

the New Zealand No. 1; and whereas with ordinary white clover a six months' growing period may be regarded as satisfactory, with a New Zealand No. 1 and its selections some growth of white clover under reasonable treatment may be expected, in the North Island at least, for almost the twelve months of the year. This long seasonal range of growth is of very great value for two important reasons: (1) Phosphatic manures may be applied almost at any time of the year with the assurance that there will be no leakages as a result of the manure being applied and becoming

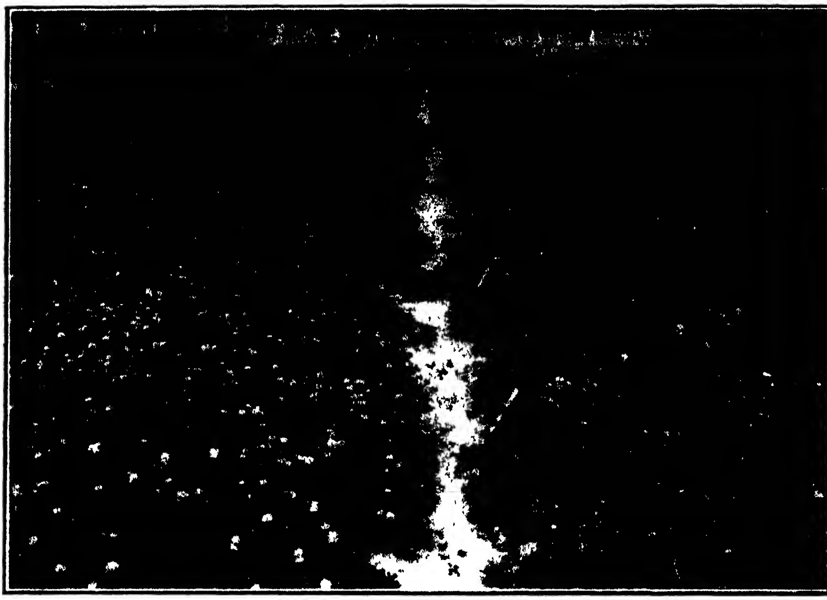

FIG. 2. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES. NEW ZEALAND NO. 1 (SELECTION), TWO PLOTS ON RIGHT; NEW ZEALAND DUTCH TYPE ON LEFT.

Note the marked earlier and prolific flowering of the latter type. Photographed 31st January, 1933, when plots were four months old. Compare with fig. 3.

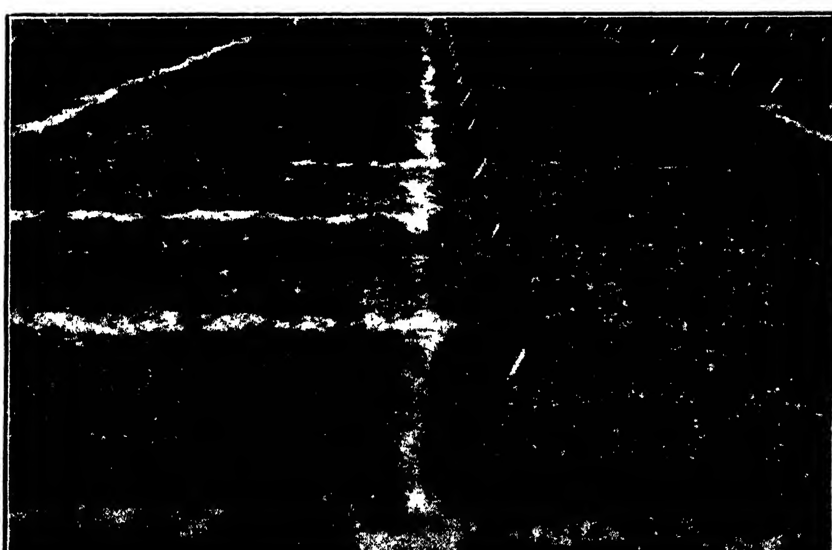

FIG. 3. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES. NEW ZEALAND NO. 1 (SELECTION), TWO PLOTS ON RIGHT; NEW ZEALAND DUTCH TYPES ON LEFT.

Same plots as shown in fig. 2, but photographed, 9th August, 1933. The New Zealand Dutch types are rapidly running out and are being replaced by sorrel. [*Photos, E. Bruce Levy.*

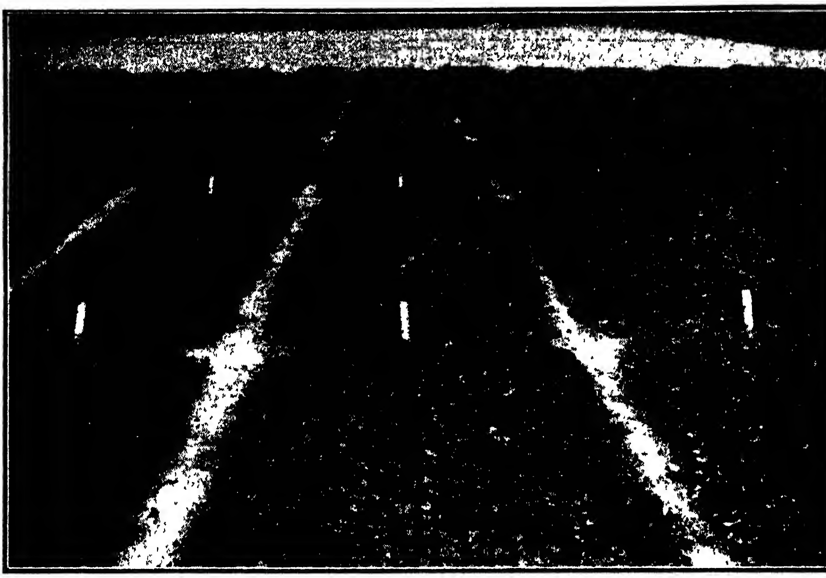

FIG. 4. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES WITH KENTISH WILD WHITE AND MORSO

Three plots mid-centre, left to right—(1) Kentish wild white, (2) Morso, (3) New Zealand No 1 (selection) Photographed 25th March, 1933, at six months old. Compare with fig. 5

FIG 5. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES WITH KENTISH WILD WHITE AND MORSO.

Three plots mid-centre, left to right—(1) Kentish wild white, (2) Morso, (3) New Zealand No. 1 (selection). Photographed, 9th August, 1933. Compare with fig 4. The Kentish and the Morso are here producing poorly relatively to New Zealand No. 1 See Table 2. [*Photos, E. Bruce Levy.*

available during dormant periods of growth ; (2) the manuring programme for out-of-season growth may be designed with greater effect in dealing with long seasonal range plants than with those of a long dormant period, irrespective of how much manure is applied during the dormant periods of growth.

The clover of the sward is essentially the means by which the farmer gets value from phosphates—not that the grasses of the sward do not also immediately benefit from the phosphate dressing—but it can be said without fear of strong contradiction that phosphatic manuring gives but poor response until clover is reasonably well represented in the sward. That clover may be suckling clover, subterranean clover, white clover, or red clover according to the sward originally top-dressed, but in every case the primary effect of the top-dressing of phosphates is seen in the added growth of clover (fig. 9). This added clover growth gives a higher per acre stock concentration, and as more and more stock nitrogen is voided by the animals as a result of the higher carrying so do the grasses of the sward improve. The nitrogen fixation of the clover is also contributory to an improved grass growth. This improvement in added grass growth may be regarded as a secondary effect of the original phosphates applied Neither the primary nor secondary effects would accrue from phosphatic manuring if the clover were absent from the sward. This is fairly clearly illustrated in fig. 8, which is a photograph of the white clover production strain trials at Marton, which have been uniformly manured with phosphate and lime. The lighter-coloured plot on the left is a mixed sward sown out with an imported Dutch white clover ; that on the right is a plot sown with the same general mixture, but with Kentish Wild White instead of imported Dutch , the part plot on the extreme right is a New Zealand No 2 type. In these plots, where the clover has failed as a result of sowing a poor type, the grass sward is stunted and yellow in appearance—excepting where there are patches of stock nitrogen (darker patches appearing in the photo)—and not only is this general unthriftiness reflected in a much lower total yield, but the palatability of what feed is produced is much decreased.

A good type of white clover will pay for phosphatic manuring better than will suckling clover, subterranean clover, or an ordinary type of white clover. In other words, £1 per acre spent in phosphatic manuring will give a greater return from good strains of white clover than from ordinary strains, and this is particularly true in manuring for out-of-season growth. In the trails covered by Table 2 all plots had equal dressings of superphosphate, and it is plainly obvious that the better strains made the most use of such dressings (compare fig. 1).

In assessing the relative values of white clover strains, it must be pointed out that white clover is seldom, if ever, sown pure, and when combined with several other species of grasses and clovers there is a levelling-up in the production from the sward due to the species other than white clover competing for room and producing concurrently with the white clover and during those periods of low

white clover production. The art of formulating seed mixtures is bound up in blending species or strains that alternate rather than coincide in reaching their peak of production.

In a series of white clover strain trials conducted at Marton under the ægis of the Crop Experimentalist (Mr. A. W. Hudson) the influence of the mixture as against the pure sowing is clearly seen in assessing the relative production of the sown clover types. Here a New Zealand No. 1, New Zealand No. 2, ordinary New Zealand, Kentish Wild White, and Dutch white clover and a line

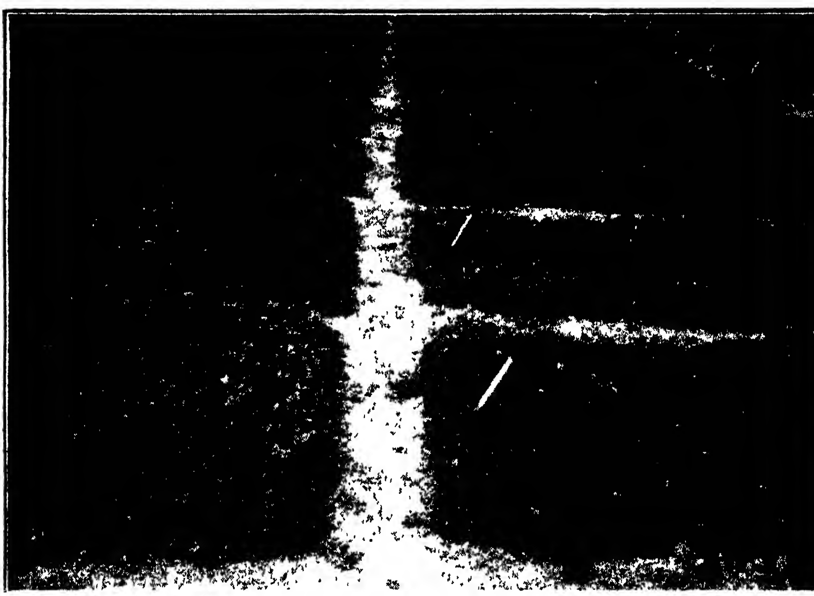

FIG. 6 COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES WITH LINES OF AUSTRALIAN ORIGIN.

Left, New Zealand No 1 (selections), right, two plots in foreground of Australian origin which fall into our reject for certification class The third plot on the right is a New Zealand No. 1 mother-seed standard. Photographed 18th March, 1934, at eighteen months old.

[*Photo, E. Bruce Levy.*

of Montgomery red clover are sown out with a base mixture of certified perennial rye-grass, cocksfoot, and crested dogstail. Production is measured under the Hudson system of alternate mowing and grazing, and the relative performance of the white clover types in this trial over a period of eighteen months is set out in Table 3. It will be noted that differences in performance in this trial, although extremely significant, are entirely different from those in Table 2, where the measurements were made on pure clover plots. Dry matter determinations throughout the trial at Marton have been made by the Plant Research Station's chemist, Mr. B. W. Doak.

Table 3.—***Showing Actual and Relative Production of White Clover Types when sown out in Association with a mixed Sward of Grasses. Trials conducted at Marton under the " Hudson " System of Alternate Mowing and Grazing. Sown 9th January, 1933.***

(*a*) Total actual green weight in pounds produced for each period, (*b*) total dry matter, (*c*) relative total green weights produced for each period; (*d*) relative dry matter for each period New Zealand No 1 = 100 for each period in each case.

White Clover Type.	Period I,* 9th January, 1933, to 28th April, 1933: 109 Days		Period II * 28th April, 1933, to 24th August. 1933 118 Days.		Period III,* 24th August 1933, to 24th October, 1933 61 Days		Period IV,* 24th October, 1933, to 13th April, 1934. 171 Days.		Period V,* 13th April, 1934, to 14th May, 1934: 31 Days		Period VI,* 14th May, 1934, to 10th July, 1934: 57 Days.	
	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)
New Zealand No. 1	19,616	2,997	5,555	1,044	9,905	1,765	32,720	5,774	2,148	402	3,014	555
New Zealand No. 2	19,009	2,912	4,971	949	8,853	1,647	26,933	5,032	1,968	378	2,434	480
Kentish Wild	19,444	2,993	5,624	1,024	9,385	1,725	25,296	4,754	2,128	408	2,610	512
Imported Dutch	19,523	2,958	5,178	959	9,421	1,720	18,147	3,668	2,231	428	1,719	363
New Zealand ordinary ..	19,441	2,962	5,193	980	8,692	1,616	23,589	4,534	2,199	422	2,185	444
	(*c*)	(*d*)	(*c*)	(*d*)	(*c*)	(*d*)	(*c*)	(*d*)	(*c*)	(*d*)	(*c*)	(*d*)
New Zealand No. 1	100	100	100	100	100	100	100	100	100	100	100	100
New Zealand No. 2	96·9	97·1	89·5	90·9	89·4	93·3	82·3	87·1	91·6	94·1	80·8	86·5
Kentish Wild	99·1	99·9	101·2	98·1	94·7	97·7	77·3	82·3	99·1	101·7	86·6	92·2
Imported Dutch	99·5	98·7	93·2	91·9	95·1	97·4	55·5	63·5	103·9	106·7	57·0	65·4
New Zealand ordinary ..	99·1	98·8	93·5	93·9	87·8	91·5	72·1	78·5	102·4	105·2	72·5	80·0

* Throughout periods I and II rye-grass was dominant and virtually the only species producing In period III rye-grass was dominant with the clovers commencing to contribute to the sward In period IV rye-grass was dominant at first, but later in the summer clover became dominant, particularly in the plots sown to the better types. In periods V and VI rye-gass again assumes dominance but with some white clover, particularly the stronger-growing types, contributing well in the sward.

The significance of the figures in Table 3 may be seen in the summarized grand total of herbage produced (1) since the pasture was laid down to the last weighing on the 10th July, 1934—*i.e.*, over an eighteen-month period; and (2) since the time that the sown clover began to contribute to the sward—*i.e.*, since about the middle of August and over a period of eleven months.

Table 4.—Showing Actual Total and Relative Production of Pasture at Marton since Date of Laying-down and since the White Clover first commenced to contribute to the Sward.

White Clover Type.	From Commencement of Trial Pasture Eighteen Months down.				From Period Clover commenced to Contribute to the Sward: Eleven Months' Period.			
	Green Weights: Pounds per Acre.		Dry Matter: Pounds per Acre.		Green Weights: Pounds per Acre.		Dry Matter: Pounds per Acre.	
	Actual.	Relative.	Actual.	Relative.	Actual.	Relative.	Actual.	Relative.
New Zealand No. 1	72,957	100	12,537	100	47,787	100	8,496	100
New Zealand No. 2	64,168	87·9	11,398	90·9	40,188	84·1	7,537	88·7
Kentish Wild	64,487	88·3	11,416	91·0	39,419	82·5	7,399	87·1
Imported Dutch	56,219	77·0	10,096	80·5	31,518	65·9	6,179	72·7
New Zealand Ordinary	61,299	84·0	10,958	87·4	36,665	76·7	7,016	82·5

The New Zealand No. 1 type used in this trial was seed from a mass selection made by the station at Palmerston North, and may be somewhat better than a normal New Zealand No. 1 ecotype. It will be seen, however, that this type is outstandingly ahead of any other type, with the New Zealand No. 2 and Kentish Wild White running about equal for second place. The New Zealand No. 1 type at Marton was the first clover to contribute to the sward in August, and apart from a one-month period between the middle of March and middle of April, which is difficult to account for at the moment, has done extremely well through the late autumn and winter period, as the actual and relative figures in period VI of Table 3 will indicate. Analyses of the cut herbage of the last weighings made on this plot during period VI showed the composition of the sward as follows: 62 per cent., rye-grass; 33 per cent., New Zealand No. 1 white clover; 5 per cent., odd species. The imported Dutch white clover plot has fared badly, and has shown itself unable to compete at all successfully with the associate grasses—mainly certified rye-grass—and at the date of writing little or no white clover is surviving in this plot.

A possible explanation of the slightly depressed yield of the New Zealand No. 1 type for the one-month period referred to may lie in the fact that this period is essentially a change-over from clover dominant to rye-grass dominant, the clover declining and the rye-grass recovering after autumn rains. There is just the possibility that during this period of change-over that the prior heavy clover growth suppressed the rye-grass somewhat, and the rye-grass recovery back to a full sward is somewhat slower than is the case where a less aggressive white clover type is present in the sward. This is fairly clearly shown in period V in the case of imported

Dutch white type, which for this period outyielded all others, due, no doubt, to the fact that the stand of rye-grass had not been affected by any competition from white clover during the immediately prior clover period.

The soil type at Marton prior to working, draining, and manuring carried a rather stunted sward of Brown-top. It is a soil type peculiarly free of volunteer white clover, and thus we may take it that the white clover content now secured there for these trials is as a direct result of the clover sown down in the mixture applied.

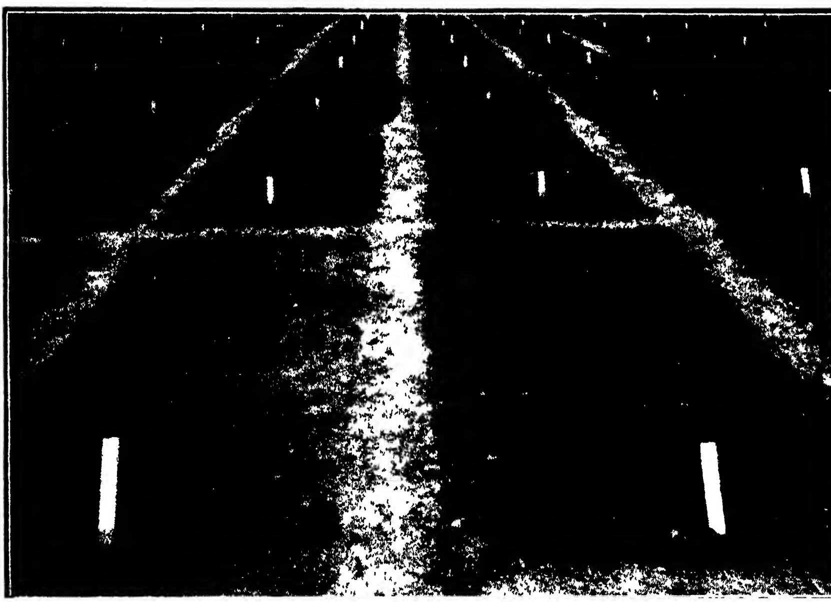

FIG. 7. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES WITH IMPORTED DUTCH AND KENTISH WILD WHITE.

Fore-left, imported Dutch white clover; right, Kentish wild white; mid-row from left, New Zealand No 1; two plots New Zealand ordinary; certified permanent pasture. Third row back, single plant selections ex New Zealand No 1 type. Extreme plot on left, New Zealand ordinary.
[Photo, F. Bruce Levy.

The results as set out in Tables 3 and 4 are by no means final, as it is intended to carry on these trials until such time as persistency of the types and a stabilized performance under the conditions of the trial are definitely shown.

As indicated above, in comparing the yields at Marton with those secured at the Plant Research Station at Palmerston North where the types are sown pure, the differences between one type and another are not so great; but, nevertheless, the differences are of such an order as to warrant one giving the greatest of care to the type of white clover included in any pastures sown.

Ecological Considerations in regard to White Clover Types.

Ecologically we may have to consider type in white clover apart from the total production of which any one strain is capable under an ideal set of conditions for growth, and this brings up the all-essential point of the grazing management and soil conditions in regard to strain—more particularly in regard to tall-growing and high-producing strains as distinct from low-growing and low-producing strains. In certain of our field plot trials that are being conducted on many soil types throughout New Zealand, while

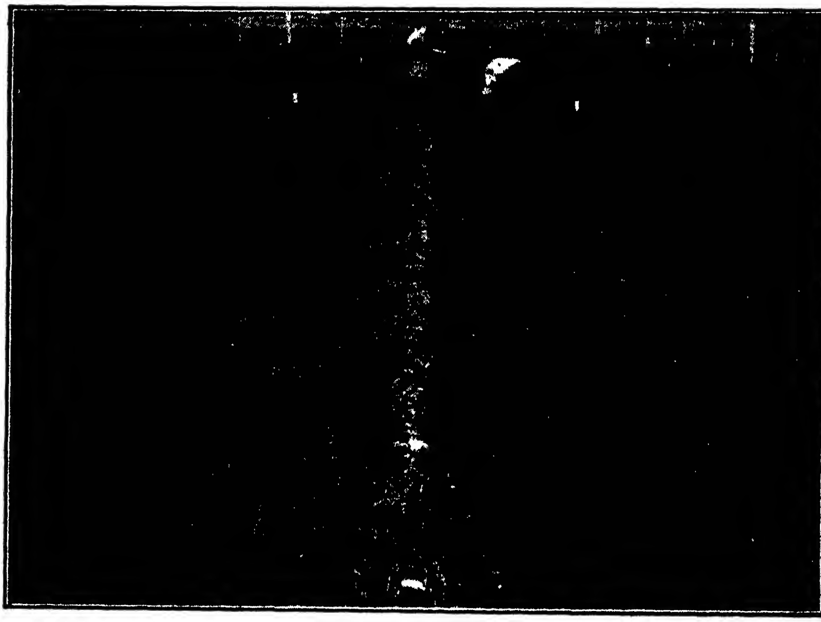

FIG. 8. WHITE CLOVER AND ITS BENEFICIAL EFFECTS ON THE ASSOCIATE GRASSES OF THE SWARD.

A view of the white clover strain trials under the Hudson system of alternate mowing and grazing at Marton. Point analysing in progress. All clover types sown with certified rye-grass, cocksfoot, and crested dogstail. Plot on left includes imported Dutch white, that on right, Kentish wild white; and part plot on extreme right, New Zealand No 2 type. The lighter colour of the Dutch plot reflects the pale, unhealthy state of the associate grasses compared with the dark-green of the Kentish wild white and other good clover types.

[*Photo, E. Bruce Levy.*

the New Zealand No. 1 is proving superior under almost all conditions sown, yet under certain styles of management the low-growing strains such as Kentish Wild White are giving the most pleasing swards, and we can well envisage a set of conditions where the Kentish Wild White will prove superior to any other type of white clover in New Zealand. Under reasonable treatment, however, we are inclined to place the main types of white clover in

the following order of agricultural utility: First, New Zealand No. 1 and selections therefrom; second, New Zealand No. 2; third, Kentish Wild White; fourth, Ordinary New Zealand; fifth, New Zealand Dutch and imported Dutch types.

Ecologically we would place these as follow:—

Group 1: New Zealand No. 1 commands a rich fertile soil-type—naturally fertile, or made so by top-dressing—where there is strong competitive growth for the greater part of the year, and where the grazing is lenient rather than severe.

Group 2: New Zealand No. 2. Fertile soil-types, but less so than 1, and where there is shorter growth with a corresponding lessening of competitive effects.

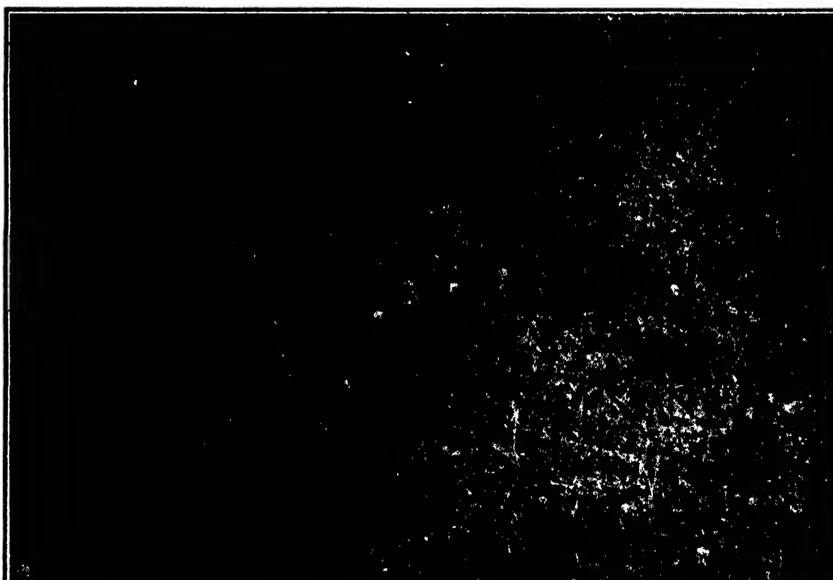

FIG. 9 WHITE CLOVER IN THE SWARD—THE KEY TO SUCCESS IN PHOSPHATE AND POTASH MANURING.

The primary effect of phosphate (or potash) manuring is reflected in the clover growth (right). This added clover by its nitrogen-fixation has a direct marked effect on the soil, and the extra growth produced raises the stock concentration per acre, which means more and more stock nitrogen for the grasses of the sward. [*Photo, E. Bruce Levy.*

Group 3: Kentish Wild White. Moderately fertile soil-type and where the growth is short and competitive effects are greatly reduced, particularly in the winter.

Group 4: New Zealand ordinary white clover. A fairly comprehensive range of soil-types and conditions where phosphatic manuring is practical, and where the sward is sufficiently open in the autumn to permit of reseeding. Essentially a volunteer type under cultivation, as in cereal and crop production, but not nearly so annually inclined as is the New Zealand Dutch and imported Dutch types.

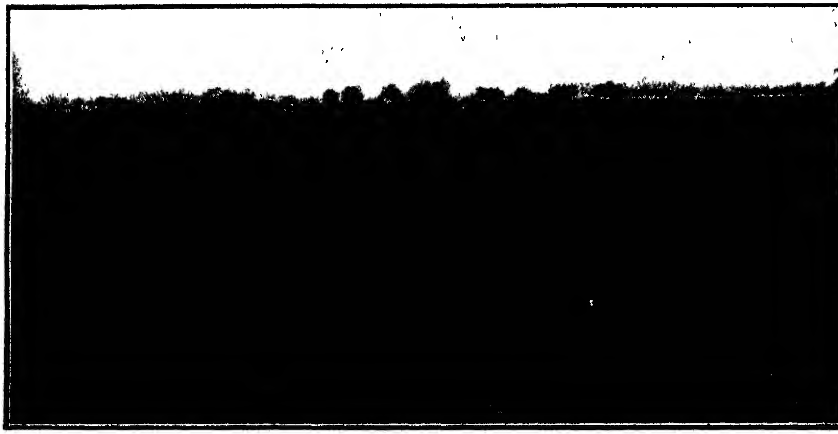

FIG. 10. THE ECOLOGY OF WHITE CLOVER TYPES.

An eco-habitat in Hawke's Bay for New Zealand No. 1 white clover Under lenient grazing with bullocks, associated with rank pasture growth spring and summer, the New Zealand No. 1 type is approaching the Station selections made ex this type, the highly competitive cover smothering out all but the high-producing tall-growing strains.

FIG. 11. THE ECOLOGY OF WHITE CLOVER TYPES.

The same eco-habitat as in fig. 10, under dairying. Here the white clover is a typical New Zealand No. 1 type. The New Zealand No. 1 type is also maintained here in an adjoining paddock under lenient sheep grazing.

[*Photos, E. Bruce Levy*

Group 5: New Zealand Dutch and imported Dutch types. Essentially free-flowering and quick-maturing annual types concomitants of arable farming where the annual crop plays an important part on the farm or where the sward so opens up in the summer as to afford every opportunity for re-establishment of the type from shed seed.

In groups 1, 2, and 3 we may regard the clovers as being true perennial types, provided they are not eliminated by smother or starved or grazed out of existence. The question to decide is just where each of these types fit in best so far as soil-type and sward management are concerned. It may be taken as a general axiom

FIG. 12. THE ECOLOGY OF WHITE CLOVER TYPES.

Almost identically the same eco-habitat as in fig. 10 under really excellent sheep management of the more or less set grazing type. Here the white clover dominant is a typical New Zealand No 2 type The question before us is, Could a New Zealand No. 1 type of white clover persist under a high sheep concentration under a rational system of rotational grazing?

[*Photo, E. Bruce Levy.*

that no white clover will produce well without phosphatic manuring, and we would tentatively say wherever conditions are sufficiently moist to render superphosphate available that the New Zealand No. 1 will respond the best to such manuring, but if these three clover types are left to their own resources as far as manuring is concerned, then we would say that the Kentish Wild White would survive longer than the New Zealand No. 1 or New Zealand No. 2.

As far as sward management—*i.e.*, method of grazing or utilization—is concerned, given a uniform soil-fertility condition we would expect from our experiences to date that the New Zealand No. 1 would excel under a somewhat lenient system of grazing, such as would obtain under a rational system of rotational grazing. The New Zealand No. 2 would excel under a somewhat more drastic system of grazing where the leafage is never allowed maximum

FIG. 13. NEW ZEALAND NO I WHITE CLOVER TYPE COMPARED WITH OTHER TYPES UNDER VARYING DEGREES OF SOIL DRYNESS.

Soil type 1—fairly moist during summer New Zealand No 1 type is mid-plot behind front labels; on its left is a New Zealand ordinary type, and on its right an imported Dutch type The part plot immediately in front of the New Zealand No. 1 is Kentish Wild White. Compare with figs 14 and 15.

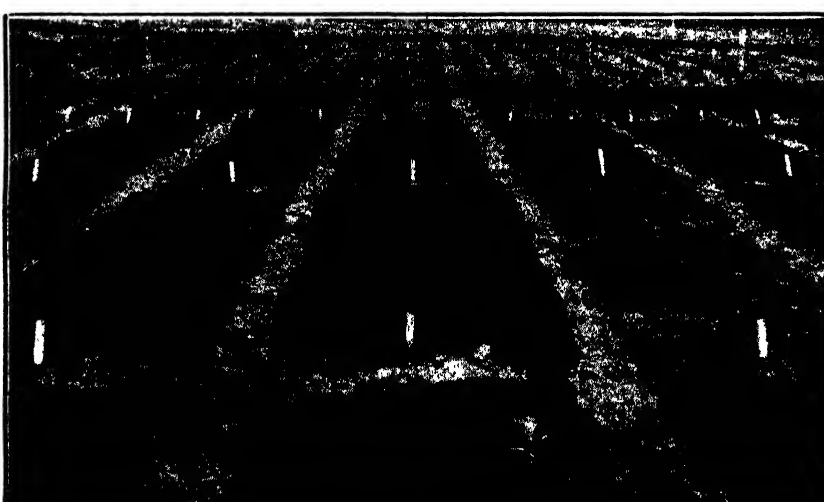

FIG. 14. NEW ZEALAND NO. 1 WHITE CLOVER TYPE COMPARED WITH OTHER TYPES UNDER VARYING DEGREES OF SOIL DRYNESS.

Soil type 2: Dry during summer period. New Zealand No. 1 is mid-plot behind front labels. The plot on the left is New Zealand No. 2 type dominant, and that on right is imported Dutch type. In the back row 1, 2, 3, and 5 from left are New Zealand No. 2 type. No. 4 is a New Zealand No. 1 type. Compare with figs. 13 and 15. [*Photos, E. Bruce Levy.*]

development. The Kentish Wild White would excel under a system of drastic, close, and continuous grazing, and it would outlast any other type of white clover given such treatment.

It is well known that cocksfoot, broad red clover, and Montgomery red clover produce but little feed and ultimately go out under a system of close and continuous grazing, and it is felt in strain-building work that this fate is awaiting high-producing strains of whatsoever species we choose to work on. The New Zealand No. 1 white clover and selections therefrom come essentially into

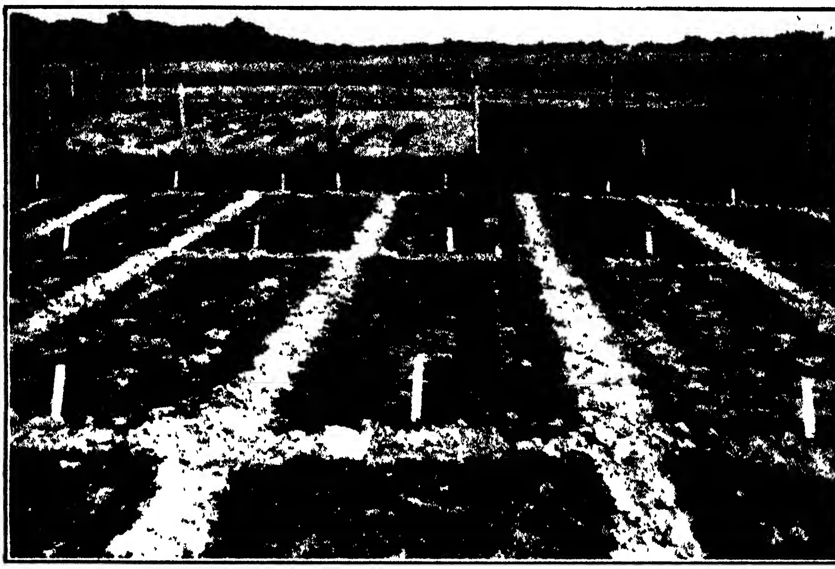

FIG. 15 NEW ZEALAND NO. 1 WHITE CLOVER TYPE COMPARED WITH OTHER TYPES UNDER VARYING DEGREES OF SOIL DRYNESS

Soil type 3 Extremely dry during the summer period New Zealand No 1 mid-plot with a New Zealand No 2 type on left and imported Dutch on right In back row plot 1 is a New Zealand No 2, 2 and 3, ordinary New Zealand; 4 and 5, New Zealand No 2 It was noteworthy that when rains fell the New Zealand No 1 made the best recovery on all soil types. Compare figs 13 and 14 [Photo, E Bruce Levy.

the category of tall-growing, high-producing types, and thus these are likely to give way to lower-producing types under a system of grazing that does not permit of its maximum growth. This is interestingly brought out in certain parts of Hawke's Bay, where normally the New Zealand No. 1 type of white clover abounds. Under a system of loose management where light grazing with cattle characterizes the management and where the growth in the spring and summer is usually rank and consists of Prairie grass, cocksfoot, rye-grass, and New Zealand No. 1 white clover dominant, the class of white clover in that area is almost equal to the Station selections made ex the New Zealand No. 1 type in growth and production. It is presumed this style of management over a

period of years has eliminated all types of white clover excepting the extra tall and vigorous growing types that alone were able to survive the dense smother from the competing grass growth. In the vicinity of the above paddock on the one side is dairying and the other side sheep. These are under typical dairy management and somewhat lenient sheep management respectively, and the typical New Zealand No. 1 type predominates (figs. 10–12). Within the same area where intense sheep-grazing has been practised over a long period of years the type of white clover is dominantly New Zealand No. 2, and it is presumed this type has survived and that the typical New Zealand No. 1 has been eliminated as a result of the severity of the grazing. The soil-type under review may be too highly winter-producing for the Kentish Wild White to persist, but it would not take much seeking to find areas of good country that are being closely and continuously grazed where the Kentish Wild White type of clover would persist after the New Zealand No. 1 and New Zealand No. 2 types had been eaten out. The inference to be drawn from this is that methods of grazing affect production from the same soil-type in relation to the production that may be secured from, say, the New Zealand No. 1 white and that from the Kentish Wild White type which produce, relatively, as approximately 2 to 1—*i.e.*, close and continuous grazing methods can possibly reduce production by fully 50 per cent. of what would be possible from that same soil under a more lenient system of grazing.

In grassland management, therefore, it seems a reasonable plan, when we know that the most desirable, high-producing species and strains thrive best under a system of grazing and spelling, to make every endeavour to suit our management to the demands of the pasture species or strains, so as to give them every chance to produce, rather than to accept low-producing, inferior species and strains because these fit in best with a system of grazing that is perhaps somewhat easier to carry out.

The call for a system of rational rotational grazing becomes more and more imperative as strain-building, incorporating high production as an essential feature, proceeds. Experiments are in hand to test out types of white clover under varying methods of defoliation: (1) Under close and continuous grazing by sheep; (2) under normal set stocking with sheep; (3) under rotational grazing by sheep. Mowing will also be made: (1) Close and continuous, (2) moderately frequent, (3) at a stage when grazed under the rotational grazing system as applied with sheep above. This work will give some information on the effects of severity or leniency of defoliation in regard to type, and this information really is necessary before the production of pedigree seed can proceed with full and complete confidence that the best strains are being evolved for, maybe, a rather wide set of conditions necessitated through the practical limitations of the farmer or locality. In agriculture, as in all phases of industry, the ideal conditions for production cannot always be economically secured, and in preparing for an all-round advance an eye must be kept on the economic developmental phases that precede the ideal. Hence, in pedigree-seed-production work it is possible that more than one strain of any one species

will require attention. At the present time the Plant Research Station is building towards pedigree strains in relation to New Zealand No. 1 white clover, but time and experience alone over a wide range of soil-types and conditions will indicate whether New Zealand No. 1 type is the only type that should be produced on a pedigree basis.

Evidence accumulating from Field Trials.

Definite clover types have now been sown out in twenty-three experimental sowings throughout New Zealand under average field conditions, and thirty more lots are being prepared for sowing this coming spring and autumn. Generally speaking, the indications to date from these trials are that the New Zealand No. 1, in the early years of the sward, at least, is the best type under average to fertile soil conditions, and is superseded in but a few trials only by other types on harder and more impoverished soil conditions. From these field trials comes evidence of two kinds in relation to sown clover types: (1) In the dry, harder habitats no differences are discernible between one type and another, and it is just a question whether the sown clovers have established. In certain instances it is definitely the case that failure of the sown white clover to establish is responsible for the little or no differences seen. Where a fair establishment has been effected under hard conditions, field reports are in favour of Kentish Wild White as making the best sward, although even here the New Zealand No. 1 is well to the fore. (2) In the case of those trials where the conditions have been sufficiently moist for germination and establishment of white clover to become effected, the evidence is outstandingly in favour of the New Zealand No. 1 type as being superior to all other types, but with Kentish Wild White scoring in appearance under closely grazed conditions or where the conditions are less fertile. It is reported by most observers and emphasized that the health and colour of the associate grasses of the sward is better wherever a good stand of white clover is secured, and the influence of the more vigorous types of white clover on sward palatability has been recorded in many of those field-plot trials. In certain instances certified perennial rye-grass plus New Zealand No. 1 white is proving more palatable than false perennial rye-grass lots that are associated with a poor clover type.

A field trial laid down at Palmerston North on a light undulating sandy and shingly soil-type that dries out badly in the summer, particularly on the crests, is of interest in respect to performance of the New Zealand No. 1 type as against all other types. On this area some five hundred lines of white clover were sown, including all New Zealand types and some from overseas. Figs. 13–15 indicate under three soil conditions the superiority in growth and persistency of the New Zealand No. 1 type, and in Table 5 are set out persistency data in the second summer period of these trials.

This trial was conducted under a somewhat lenient system of grazing with sheep, and this may have favoured persistency of the New Zealand No. 1 type as against Kentish Wild White, for example, which suffered considerably by volunteer grass invasion. This latter type was sown on only the better soil-type. The Dutch types were entirely replaced by weeds and volunteer grass after eighteen months down, and it would appear as though no method of grazing would perpetuate this type.

Table 5.—Showing relative Performances of White Clover Types on Three Soil-types during a Drying-out Summer Period, 1933 Point Analyses made 6th March, 1933.

Clover Type	Soil Type 1: Percentage of Ground Cover.			Soil Type 2: Percentage of Ground Cover.			Soil Type 3: Percentage of Ground Cover.		
	White Clover.	Bare Ground.	Weeds	White Clover	Bare Ground	Weeds	White Clover.	Bare Ground.	Weeds.
New Zealand No. 1	64	34	2	60	37	3	33	63	4
New Zealand No 2	63	28	9	47	49	4	31	67	2
New Zealand Ordinary	41	53	6	28	62	10	19	78	3
Imported Dutch	17	56	27	8	75	17	6	76	18
Kentish Wild White	53	38	9	..	..	..	..	..	..

In conclusion, the New Zealand No. 1 type of white clover is outstanding, and it sets an ideal for even the most up-to-date farmer to strive for, an ideal that will reflect optimum manuring, efficiency in herbage utilization, and the maximum in production. New Zealand No. 2 and Kentish Wild White also afford good types of clover for intermediate soil types and conditions, but it is our opinion that wherever the conditions on the farm favour fair to good white clover growth that the New Zealand No 1 type ultimately should be sown, and every endeavour made by manuring and management to make this the dominant white clover type on the farm. At present the supply of seed of New Zealand No. 1 type is extremely limited. It is sold as New Zealand certified white - mother-seed standard; New Zealand No. 2 is sold as New Zealand certified white—permanent pasture standard; and seed of Kentish Wild White would need to be imported, as there are no supplies of this clover in New Zealand at the present time.

SOME GUIDANCE RELATIVE TO SEASONABLE CARE OF DAIRY COWS.*

T. H. HANKIN, Veterinarian, Department of Agriculture, Masterton.

THE modern dairy cow has, by a process of selection, been evolved into a highly specialized organism and, with the primary object of heavy milk-yield being the guiding principle of this selection, the stamina of the animal has, to a certain degree, been neglected. In consequence, the cows of to-day require more attention to keep them in good health than did their ancestors of fifty years ago; and the complaint of the dairyman that it is always his best cows that seem to get into the most trouble has some foundation in fact. Calving-time is a critical period with all cows, particularly with the high producer, and more attention could well be given to measures which minimize trouble at this season.

Of considerable importance is the question of shelter from the inclement weather. The cow, like all other animals, requires food to produce energy and warmth. It takes a definite amount of food to produce a definite amount of heat and, as the healthy animal body must remain at practically a constant temperature, a moment's

* Substance of lecturette broadcast from Station 2YA.

reflection will show that an animal kept warm and dry will require less food than the one that is wet and cold. But, alas! Often the wet and cold beast gets less food than her better-cared-for sister. Hence, the provision of shelter-belts of trees, live hedges, and rugs is a distinct economic advantage to both man and beast. If such provision is not practicable for all the farm stock, every endeavour should be made to provide suitable accommodation for the cows about to calve. The ideal is a snug, level paddock close to the homestead and surrounded by hedges in which all cows can be calved — a maternity home, as it were. When it is seen that a cow is within a few days of calving, she should be taken to this paddock and kept under observation—given assistance if necessary, and carefully watched for at least two days after the calf is born for any sign of the onset of parturient paresis or so-called milk-fever. Further, observations relative to the incidence of contagious abortion may be made more readily if cows are calved in such a paddock. The term "milk-fever" is really a misnomer, as the patient's temperature, instead of being raised, is subnormal.

The direct cause of parturient paresis is a temporary deficiency of calcium in the bloodstream and recent research has shown that injection into the circulation of suitable calcium salts can, in many cases, bring about recovery, but for general treatment, the older method of udder inflation is still the most satisfactory. For a particular cow that one thinks is likely to go down with milk-fever, a preventive drench of 2 oz. of calcium chloride in a quart of water may be given at calving-time, but this precaution does not absolve the owner from being prepared for the onset of an attack later on

There is ample justification for emphatically warning farmers against drenching a cow when she is actually suffering from an attack of milk-fever, as, at that time, the animal has no nervous control over her throat and some of the medicine is just as likely to go down the windpipe into the lungs, as down the right way into the stomach. Any quantity of foreign matter going into the lungs gives rise to a fatal pneumonia. It often happens in milk-fever cases that have not been found until the cow has been down and lying on her side for some hours, that the paunch is full of gas, and green matter is oozing from the unconscious patient's nostrils. The cow responds to treatment for milk-fever, but a few days later, is dead from pneumonia caused through breathing into the lungs some of that green matter that had come up from the stomach when she was lying on her side. With the maternity paddock in use, this particular cow would have been noticed when symptoms of milk-fever first developed, and she would not have been allowed to reach the stage when stomach contents come up into the nostrils.

In a case of milk-fever it is essential, after the udder has been inflated, that the patient be kept up on her brisket by such means as a bale of hay or a sack of chaff, hay, or earth forced in behind her shoulder blade. It is well to remember that she is suffering from a species of shock and has lost a good deal of heat, so cover her up with plenty of straw, rugs, sacks, &c., and then leave her alone for an hour or two. When consciousness has returned, a drink of luke-warm water may be offered to her, but one should not be in a hurry to force anything down her throat. If she has not made progress towards recovery within, say, three hours, it is advisable to inflate her udder again. The danger of udder inflation is that infection may

be introduced into the organ, if cleanly methods are not practised, with a very bad form of mammitis as a sequel. Therefore it is necessary to be particularly careful to cleanse the teats thoroughly and to pay attention to the teat siphon, which should be sterilized immediately before use. This is best done by boiling the instrument in a small saucepan of water for five minutes. Then proceed as follows: Remove the saucepan from the fire and carry it and its contents to the patient's side. Be careful when using the teat siphon not to handle that part of it which is to be introduced into the cow's teats. Milk out what little milk there is in the udder and carefully insert the siphon into the teat canal for about an inch, and then use the pump at a reasonable rate of speed, until the quarter is expanded fairly tightly with air. Withdraw the siphon and pinch the end of the teat with the thumb and forefinger for a few seconds. Some air will escape, which is of no moment. However, if thought desirable, in cases of very easily milked cows, a piece of rag or tape may be tied around the teat to prevent further leakage of air, but the ligature should not be left on for more than about a quarter of an hour, as its retention may lead to serious injury of the teat. Repeat this treatment with the other quarters and then prop the cow on her brisket and cover her up as described before. It is to be remembered that a cow may go down with milk-fever again after recovery from the original attack, so that it is advisable to keep the patient under observation for a day longer.

As a general rule, milk-fever is associated with recent parturition, but occasionally a cow goes down before the calf is actually born. Then, there are those cases which show all the symptoms of milk-fever, but, as the animals have not recently calved, the owner is misled, and decides that they cannot be suffering from this complaint. Both these types of cases respond to treatment for parturient paralysis, and one should not hesitate to inflate the udder when a cow, under any circumstances, shows symptoms simulating milk-fever.

There is a form of paralysis that often occurs a few days after calving in which the cow seems to lose the use of her hind legs, and is unable to raise herself from the ground. Temperature, eye, and appetite appear about normal, and the cow remains in the natural recumbent position making occasional futile attempts to get on her feet. Provided the patient is in a sheltered place, she may remain where she is, but, otherwise, it is desirable to sledge her into a convenient shed. As a preliminary treatment, give ½ lb. to 1 lb. of Epsom salts dissolved in 1 to 2 quarts of hot water, and follow this immediately with 4 oz. of baking-soda dissolved in 1 quart of *cold* water. Give ½ oz. doses of powdered nux vomica in a little water twice daily for three to five days. If the bowels are not functioning well after the first day, smaller doses of Epsom salts, say 4 oz. to 8 oz., should be given daily. Sometimes a plaster is applied to the loins and rump, and this may be made as follows: Take two tablespoonfuls of mustard and an equal quantity of flour, mix with cold water until the mass is of the consistency of thin cream, rub on to parts, and finally put a sheet of thick brown paper over the plaster. A balanced ration should be given consisting of good hay, green feed, and a few roots if available, together with a plentiful supply of drinking-water. Prairie-grass is particularly good as a part of the green feed. Do not be in a hurry to get the cow on her feet, but let her lie comfortably for several days, seeing to it that she has plenty of bedding. If she

has ceased making attempts to rise by the fourth or fifth day, try giving her a sudden fright with a dog or other means, and often she will succeed in getting on her feet. If this fails, leave her for another day and then get her up by lifting with man-power, if enough is available, or, as a last resort, sheer-legs with slings and a block and tackle may be used. The cow should be supported until she takes her own weight. If the animal cannot then stand alone, allow her to lie a few more days. Most cases recover within a week, and it is wrong to keep a cow in slings for any length of time. The trouble just described is not to be confused with that of those beasts which are unable to rise to their feet simply through sheer weakness due to bad management during autumn and winter. Before treating a cow that cannot rise from the ground, one should make sure that her inability to do so is not due to a fractured pelvis or limb.

The question of the desirability of giving each cow a drench after calving is an open one, but, provided care is taken in administering the medicine, no harm is done and often benefit is derived—½ lb. to 1 lb. of Epsom salts with a tablespoonful of ground ginger dissolved in a quart of water is quite good for this purpose.

It is essential that the calf should have the colostrum or beastings, and, in practice, the mother and offspring should be left together for a day. According to law, milk or cream from a cow which has calved for less than four clear days cannot be sent to a dairy factory, and, furthermore, in the export veal trade a calf has to be at least five days old, so the calf can, without any pecuniary hardship to the dairyman, be fed on its dam's milk for four days. The calf should be kept warm and dry, this applying especially to the vealer, so that the pen in which it is placed before collection by lorry should be wind and rain proof.

The development of the calf is a big strain on a cow at any time, calling especially on her mineral reserves, and, after coming through a lean winter, as so many cows do, the animals enter the milking season with these essential reserves more or less exhausted. Chief among the reserve minerals used up is calcium phosphate, which is also one of the important mineral salts of milk, and it is important that ample supplies of calcium phosphate should be available so that the milking-cows can replete their systems as soon as possible. To this end, a lick composed of equal parts of steamed bone-flour and common salt should be made available to the dairy herd. If there is a phosphatic deficiency in their systems, the cows will literally eat this mixture, but, so soon as reserves are built up in the body, an animal's craving for the lick will cease.

If a cow is in good health at calving-time, the cleanings will come away within a few hours after parturition, but, due to various causes, many cows suffer from retained placentæ. Naturally, the farmer desires this condition remedied as soon as possible, but the better way is to " hasten slowly " in this case, and leave things to nature a little. More harm is done in hasty interference than in letting things alone for a few days. The external portion may be shortened a little, but the practice of tying horse-shoes, bricks, &c., on to the dependent part is to be condemned—rather endeavour to build up the animal's health with good feeding and a drench or two. The " washing out " of each and every cow just after calving is not a desirable practice, but in those cases where a douche is really required, use plenty of fluid, say 4 to 8 gallons with a very small quantity of disinfectant added.

If the dairy cow is to fulfil her function it is necessary that her udder remain free from disease during the milking period, and I will conclude my suggestions with a few remarks regarding mammitis.

The udder of the present-day cow is a highly specialized organ selected solely for milk-production, but, unfortunately, this particular selection has lowered its resistance to disease, and so every possible precaution should be taken to protect the udder against infection. Attention to shelter, food, &c., are of importance in this respect.

One should endeavour to ensure that gateways and approaches to the milking-shed are such that the cows' udders and teats do not come in direct contact with mud, which means practically that mud nowhere should be more than 6 in. deep Remember that such mud contains great numbers of pathogenic organisms. Care should be taken that the milking-machines are not working with a greater vacuum than 15 lb., and that the gauge is correct. The teat cups should not be left on too long, and, when stripping by hand there is no need to tug at the cows' udders. A good practice is to wash the cows' teats with a solution of hypochlorite or potassium permanganate both before and after milking. This practice will tend to prevent the spread of cow-pox and infection with mammitis germs. When potassium permanganate solution loses its original colour and becomes brownish, it is useless as a disinfectant, so it is advisable to change the solution in the washing-bucket frequently A good ointment for use on the cows' teats mav be made as follows: Take 4 lb. petroleum jelly, 4 lb. good mutton tallow, and 1 lb. boracic acid. Melt petroleum jelly and tallow together in a tin, then remove from fire and stir in the boracic acid, beating the mixture until it sets.

USE OF WOODEN CRATES FOR SEED POTATOES.

J. O. WALLACE, Department of Agriculture, Dunedin.

SINCE the inception of potato-growing in New Zealand, the use of the sack as a container, both for seed and table potatoes, has been an invariable practice, and any suggestion embodying a departure from established usage in this connection will no doubt be viewed by growers and the trade with natural reservation. Despite this, however, it was considered that there might be definite scope for the development of sales of certified seed potatoes in suitable wooden containers, and permission was obtained to investigate this possibility in Dunedin. The writer has been intimately connected with the scheme since its inception, and now that it is likely to be extended, this short statement may be of interest to both growers and merchants.

In America and Canada wooden crates for the purpose mentioned are no novelty. They have been in use for some years, and are rapidly displacing the sack. They are principally and extensively used in the certified seed trade and by co-operative marketing associations in marketing selected table potatoes.

To New Zealand growers they may appear to be a novelty, but those specializing in the production of certified seed will realize that crates possess obvious advantages over the sack.

The suggested use of crates may be criticized because of the extra expense which an innovation of this nature might involve, and while

such an argument might at first appear perfectly justified, there are, nevertheless, some worthy features in the suggestion that deserve full consideration.

It is apparent from inquiries received in the past that there is a keen demand by private gardeners for genuine certified seed potatoes, and it can be said safely that herein lies a potential market that has not yet been explored in a practical way by growers. It is thought that the use of crates will facilitate catering for this demand. The use of crates would to a large degree prevent much of the trouble that arises from the bruising and the subsequent rotting of tubers that so often happen during inter-Island transport when sacks

NEW ZEALAND GOVERNMENT CERTIFIED SEED-POTATOES

REC No ______ *VARIETY* ______ *GRADE* ______

I guarantee that the package to which I attach this label contains no tubers other than those harvested from a crop of the variety indicated above and which was provisionally certified in the field by an officer of the Department of Agriculture.

Date ______ *Signed* ______

This is to certify that the grower to whom this label is issued has grown an area of potatoes of the variety mentioned above which was inspected in the field and found sufficiently vigorous and free from foreign varieties, pests, and serious disease as to warrant the issue of a provisional certificate.

On the date indicated below the graded tubers, which the grower guarantees to be the produce of the certified area, were inspected and found to be practically free from diseased or seriously injured tubers and graded in accordance with the figures indicated above.

Date ______ *Inspector* ______

The original purchasers of certified seed-potatoes are requested to examine their potatoes at once and lodge any complaints forthwith. After being kept in storage for any length of time no guarantee can be given as to their quality.

FIG. 1. STICKER LABEL TO BE ISSUED TO GROWERS.

NEW ZEALAND GOVERNMENT CERTIFIED SEED-POTATOES

We guarantee that the package to which we have attached this label contains no seed tubers other than those supplied to us by registered grower No. ______ and in respect to which we have received a guarantee signed by the grower declaring them to be Government certified seed of the variety

______
(Insert variety.)

Permit to repack issued on ______ *Signed* ______

by ______
Inspector N.Z. Department of Agriculture

FIG. 2. STICKER LABEL TO BE ISSUED TO REPACKERS.

are used. Trial cased lots sent from Dunedin to Palmerston North last year were found to be in perfect condition when opened, after having been kept at their destination for a considerable length of time.

The Department of Agriculture therefore had printed for this initial trial, sticker certification labels specially adapted for use on crates, to replace the tie-on tags issued to growers who customarily market their produce in sacks (fig. 1).

The position of retail seedsmen wishing to repack bulk lines into standard crates was not overlooked, and a special sticker label to meet their needs was also prepared (fig. 2). Repacking of bulk lines into wooden crates, and the use of these labels was permitted only under official supervision, and a charge of 6d. per hundredweight, with a minimum charge of 10s., was made in this connection.

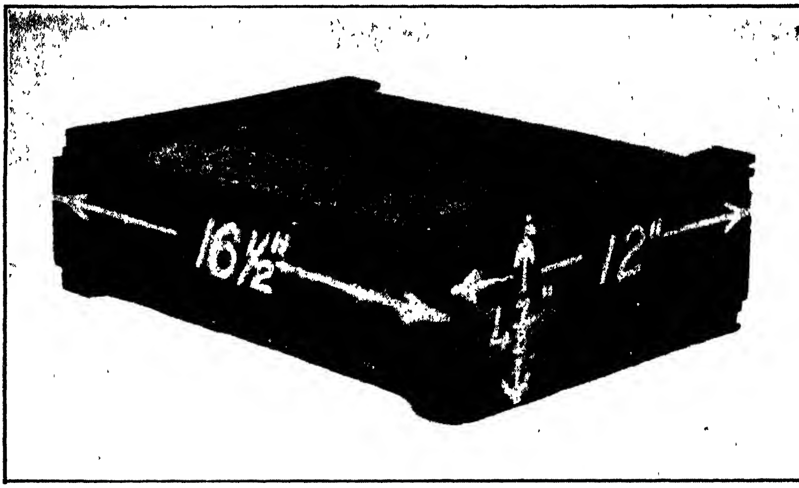

FIG 3 14 LB CRATE

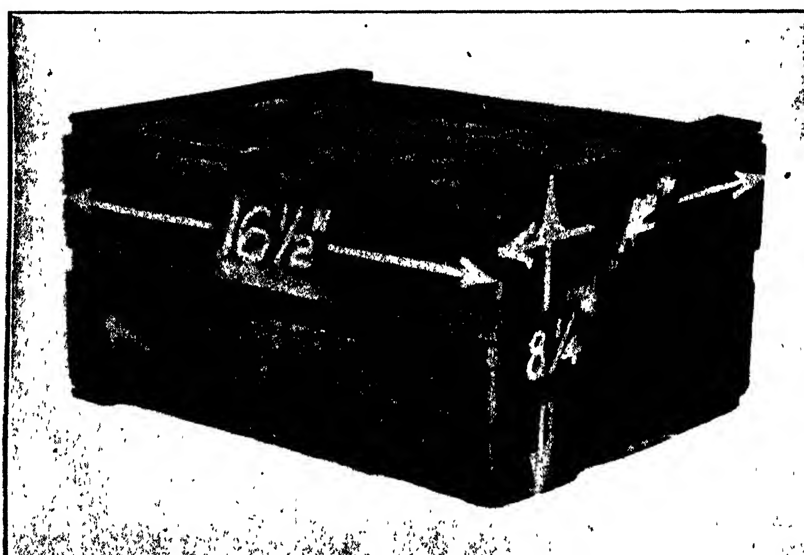

FIG. 4. 28 LB. CRATE.

Timber Specifications for Crates.

—	14 lb. Potato-crate.	28 lb. Potato-crate.	56 lb. Potato-crate.
	In. In. In.	In. In. In.	In. In. In.
Crate, inside dimensions ..	15½ x 3⅞ x 11½	15½ x 7¼ x 11½	17½ x 11½ x 11½
End pieces	(2) 11½ x 3⅞ x ½	(2) 11½ x 7¼ x ½	(2) 11½ x 11½ x ½
Side slats	(2) 16½ x 3½ I ¼	(4) 16½ x 3½ x ¼	(6) 19 x 3½ x ¼
Top and bottom slats	(6) 16½ x 3½ x ¼	(6) 16½ x 3½ x ¼	(6) 19 x 3½ x ¼
Cleats	(4) 11½ x 1½ x ¾	(4) 11½ x 1½ x ¾	(4) 11½ x 1½ x ¾

(The figures in parentheses denote the number of pieces required.)

With the object of preventing the possibility of unscrupulous individuals endeavouring to pass on to the public ordinary seed as genuine certified seed, all crates when packed and bearing official certification labels were sealed in such a manner as to prevent any one tampering with their contents.

Many styles of crates were considered, and that recommended for New Zealand conditions closely resembles the most popular crate used in America. The trial crates were constructed of New Zealand beech timber, which proved satisfactory in every way, and is accordingly recommended for this purpose.

In the initial stages of introducing the crates to the trade, three sizes were considered sufficient, and were made to hold respectively 14 lb., 28 lb., and 56 lb. Further experience may indicate that a 112 lb. crate will be required for the inter-Island trade. The 14 lb. and 28 lb. crates are illustrated in figs. 3 and 4.

In designing the crates the problems of the packer, as well as of the miller, have been kept in mind, and an endeavour has been made to have parts interchangeable in assembly as far as possible. In the case of the two smaller crates it will be noted that the ends are the only parts which differ in size

The cost will vary according to locality and distance of mill from railhead, but, as an indication of prices likely to rule, quotes for shooks of beech crate-timber of the above specifications have been obtained at 5d., 4d., and 3d for 56 lb., 28 lb., and 14 lb. respectively.

In conclusion, it is desired to express thanks to Mr. J R Wilson, of Sharps Sawmills, Tawanui, for assistance rendered in designing the trial crates, and for help in their construction.

The success that has attended the initial trial of crated certified seed potatoes has led to a decision to extend these facilities to any part of the Dominion. Particulars may be obtained from the Field Superintendents at Dunedin, Christchurch, Palmerston North, and Auckland.

—*J. W. Hadfield, Agronomist.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 12th July to 26th July, 1934, include the following of agricultural interest.—

No. 70271 : Hay-stacker ; G Butler. No. 70528 . Cultivating implement ; R. J. Bowen. No. 71834 : Separator ; G. D. Chambers. No. 72048 : Milking-system ; G. H. Gascoigne and J. R. Knox. No. 72049 : Milking-system ; G H. Gascoigne and J. R. Knox. No. 72050 : Securing wire , L. A. Miller and W. T. Howse. No. 68854 : Cheese-press ; G. J. G. Fraser. No. 71021 : Egg-grading machine ; A. Martin. No. 71343 : Watering-can ; A Billens. No. 72108 : Cutter for shearing-machine ; J. J. Bourke. No. 72129 : Preventing the deterioration of milk ; R. L. Feagles. No. 72176 : Hay-knife ; J. G. Mattson and A Cahill. No. 72211 : Fruit-case ; C. H. Miller. No. 72233 . Incubator ; L. T. Hayman. No. 72241 : Cultivator-point ; J. M. Deschamps. No. 72281 : Storage of milk ; The Aluminium Plant and Vessel Co., Ltd.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING JULY, 1934

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list supplements that published in the July Journal and refers to those crops passed during July. Further lists will be published in later issues.

In the June *Journal* was published a list of growers who have received provisional certificates. The acreage, percentages of foreign varieties present, and the group number and classification representing the relative merits of lines were given in that list, to which intending purchasers should refer.

AUCKLAND SHORT TOP.

Mother Seed—
Barrett, W. H., Springlands, Blenheim.
Caldwell, G., R.M.D., Courtenay.
Cross, A. E., Pine Farm, Bennett's, via Rangiora.
Crozier, W. J., Mount Hutt, R.D., Rakaia.
Ham, A., Grovetown, Blenheim.
Henderson, G., R.M.D., Courtenay (Line A).
Henderson, G., R.M.D., Courtenay (Line B).
Kenyon, F., Mina, North Canterbury.
Martin, W. E., R.M.D., Kaiapoi (Line A).
Morgan, D., Cheviot, North Canterbury.
Petrie, H. H., R.M.D., Swannanoa (Line A).
Petrie, H. H., R.M.D., Swannanoa (Line B).
Petrie, J., sen., R.M.D., Swannanoa.
Redmond, C., R.M.D., Kimberley.
Roper, P. F., R.M.D., Halkett.
Ryan's Estate, R.M.D., Springston.
Westaway, R. J., R.M.D., Courtenay.

Commercial Seed—
Adams, K. and R., Sheffield.
Gray, J. L., St. Andrew's.
Gray, R., St. Andrew's.
Kelleher, T., Pleasant Point, Timaru.
Musson, W., Rangiora.
McKenzie, J. R., Yaldhurst.
Oliver, J. O. J., Temuka.
Porter, E. G. Y., St. Andrew's.
Rangiora High School, Rangiora (Line A).
Rangiora High School, Rangiora (Line B).
Rich, A. J., R.M.D., Kaiapoi.
Smith, E. A., R.M.D., Springston.
Timaru Boys' High School, Timaru.

DAKOTA.

Mother Seed—
Allen, A., R.M.D., Leeston.
Chambers, A. J., "Carberry," Weedon's.
McPhail, W. A., Mitcham, via Rakaia.
Petrie, J., jun., R.M.D., Swannanoa.
Petrie, J., sen., R.M.D., Swannanoa.
Rolston, G., R.M.D., Weedon's, Courtenay.
Walker, C. E., R.M.D., West Melton.
Wilson, M., R.M.D. Halkett.

Commercial Seed—
Boag, R. A., R.M.D., Greendale.
Burrows, J., Mount Hutt Rural, Rakaia.
Campbell, D., King Street, Rangiora.
Cross, A. E., Pine Farm, Bennett's, via Rangiora.
Foster, T. C., Ladbrooks (Line B).
Gray, R., St. Andrew's.

DAKOTA—*continued.*

Commercial Seed—continued.
Ham, A., Grovetown, Blenheim.
McIntosh, H. J., Kaiapoi.
Robson, F. H., Box 22, Lincoln.
Seivwright, R. M., Meadows, Washdyke.

KING EDWARD.

Mother Seed—
Griffin, J. G., Te Waewae, Southland.
Kokay, S., Tuatapere.
Mehrtens, L. C., Box 27, Tuatapere.

Commercial Seed—
Wilkins, J. H., Milton.

JERSEY BENNES.

Mother Seed—
Burgess, D., West Plains, Invercargill.
Milburn, M., R.M.D., Wright's Bush, Gladfield.

EARLY REGENT BOLTER.

Mother Seed—
Pascoe, S., R.M.D., Halkett.

GREAT SCOT.

Mother Seed—
Wright, L. T., Annat.
Wright, Q., Annat.

ARRAN CHIEF.

Mother Seed—
Mehrtens, L. C., Box 27, Tuatapere.
Pointinghouse, W. L., Tai Tapu.
Robinson, R. G., Box 4, Papanui, Christchurch (Line A).
Teschner, C. A., Chatton Road, Gore.

Commercial Seed—
Barclay, G. M. M., Riverside Road, Waimate.
Saunders, E. E., Studholme Junction (Line A).

ARRAN BANNER.

Mother Seed—
Sheddan, G. B., R.M.D., Otahuti, Invercargill.
Wilson, C. H., Lorneville, Invercargill.
Wright, L. T., Annat.

Commercial Seed—
Henderson, G., R.M.D., Courtenay.
McNae, F., R.M.D., Courtenay (Line A).

AUCKLANDER TALL TOP.

Mother Seed—
Steele, F., Fernside, Rangiora.

—Fields Division.

At Waikuku, Canterbury, a lucerne stand now in its third season was sown with half a ton of carbonate of lime and 2 cwt. super, but without inoculation. The seed was drilled through every coulter of a grain drill and an excellent strike was obtained. The lucerne, however, remained stunted and yellow until 3 cwt. of inoculated soil per acre was applied this season following cultivation with a suitable grubber. The stand is now an excellent one.

LIVE-STOCK IN NEW ZEALAND, 1934.

UNLESS OTHERWISE SPECIFIED, ENUMERATED AT 31ST JANUARY.

Land District.	Horses as at 31st Jan., 1934.	Dairy Cows as at 31st Jan., 1934 (in Milk and Dry).	Total Cattle as at 31st Jan., 1934 (including Figures in previous Column).	Number of Sheep shorn, Season 1933-34.	Number of Lambs shorn, Season 1933-34	Number of Lambs tailed, Season 1933-34.	Sheep (including Lambs) as at 30th April, 1934	Pigs as at 31st Jan., 1934.
North Auckland	29,700	364,108	678,078	909.763	200.296	481,569	1,018,624	112,813
Auckland	44.190	595,250	1,056,633	1,383,314	370,308	931,935	1.563,899	227,887
Gisborne	15,974	62,860	414,631	2,709,833	822,657	1,374,434	2,979,519	22,607
Hawke's Bay	13,126	66,203	258,282	2,794,808	462,107	1,770,304	3,131,301	20,013
Taranaki	17,618	262,823	444,571	821,142	240,065	522,914	872,565	68,345
Wellington	34,804	267,039	751,680	5,291.847	1.326,165	3.304.413	5,787,498	91,889
Nelson..	5.693	35,279	73,972	380,127	17,719	167,915	433,958	16,778
Marlborough	5,962	18,404	44.185	1,014,693	18,598	439,737	1,068,360	6,794
Westland	2,011	16,333	46,412	66,510	7.537	50,841	78,804	6,223
Canterbury	51,577	88,658	189.398	4,350,856	21,842	2,858,557	5,350,165	46.789
Otago	29,654	66,407	152,350	3.273,241	6,243	1,822.039	3.899,032	23,905
Southland	23,629	89,167	190.723	2,021,655	6,700	1,550,039	2,462,497	16,344
Preliminary totals, 1934 .	273,938	1,932,531	4.300.915	25,017,789	3,500,237	15,274,697	28,646,222	660,387
Final totals, 1933 ..	276,897	1,845.972	4.192.023	25,069.409	2,629,837	15,015,628	27,755,966	591,582

—*Census and Statistics Office.*

SEASONAL NOTES.

THE FARM.

Seed-beds for Pastures.

WHEN the sowing of pasture mixtures is followed by results which can truly be characterized as failures, farmers relatively often request officers of the Department to endeavour to indicate why such failures have occurred. In this way a wide and varied experience relative to poor results from the sowing of pasture mixtures has been obtained. From this experience it seems as if it is not realized as widely as is desirable that in the establishment of pastures a matter of fundamental importance is the preparation of the seed-bed. Partly because of the size of the seeds widely used and partly because of the requirements of the resultant plants a fine firm seed-bed is necessary. Firmness of the seed-bed is of especial importance; at times failures which are attributed to poor vitality in seeds are found to be due to lack of firmness in the seed-bed—sometimes in areas which are almost complete failures there are small areas of successful "strikes" of seed around headlands or in other places which have been consolidated by the passage of implements or of stock. These small areas in which success has been obtained indicate that not the seed, but the lack of consolidation, is responsible for the general unsatisfactory establishment. Lack of adequate firmness is specially prone to occur in soils naturally loose—*e.g.*, those which are sandy or peaty—but at times it is prominent on heavier soils. The advisability of firmness in seed-beds for pastures is of current moment, because the most effective and economical means of securing appropriate firmness is cultivation commenced early enough and carried out thoroughly enough. The most desirable firmness is that which results from the joint effects of natural agencies such as weathering and of cultivation, and which calls for the lapse of time to supplement tillage. Cultivation, without adequate time for weathering, may readily lead to a cloddy soil which it is practically impossible to turn directly into a good seed-bed even though the individual clods are comparatively small. Such cloddy soils sometimes result on heavier types of soils from a relatively late ploughing which buries a layer of weathered mould and replaces it by a layer which is lumpy when the land dries, and which is a poor seed-bed. It seems to be overlooked commonly that firmness is required not so much in the immediate surface portion as in the soil which lies beneath it and extends to the full depth to which cultivation has been carried out. This explains why the firmness that can be obtained at the surface by the use of the roller is not at all sufficient. Disking, cultivating, or grubbing and harrowing are the pulverizing operations which, in conjunction with natural disintegration, will most readily give the firmness throughout the cultivated layer of soil which is desirable. Often too much dependence is placed upon the roller, which, as commonly used, effects consolidation only in a shallow surface layer. If the roller is used immediately after ploughing, it may be of some value in consolidating the lower portion of the layer being cultivated by directly pressing the furrows against the unbroken earth beneath, but later when the upper portions of the furrows are levelled out by tillage the pressure of the roller is more widely distributed, and hence not felt so heavily at any particular point. No implement in use in New Zealand will pack by pressure the portion of the cultivated soil with which the roller does not satisfactorily deal, and so time-saving measures in the preparation of seed-beds for pastures are as a rule not advisable—rather dependence should be placed on the pulverizing of the soil in good time by such measures

as disking and cultivating, which penetrate deeply enough to eliminate a loose condition a few inches below the surface of the soil. It is not to be deduced from the above statement that rolling is of little value; it reduces the surface soil to a good tilth and consolidates it to form a firm layer of soil in which the soil is well packed round the seed, and it facilitates the freer rise of moisture to a position from which the seeds may use it. Where consolidation is required as in pasture establishment it is normally good practice to roll before sowing to secure firmness under the seeds, which may be suitably covered by a light harrowing such as is obtained by the use of chain or brush harrows.

An unsuitable seed-bed is reflected particularly readily in poor results from clover seed, which, if not in a firm seed-bed and suitably covered with soil, will frequently germinate and die. In fact, failure with clovers may be attributed mainly either to seed-beds unsuitable because of their lack of firmness or to sowing at an unsuitable period when the conditions are too severe—*i.e.*, too early in the spring or too late in the autumn.

Pasture Establishment.

Under a wide range of conditions pastures may be sown successfully in September As companion crops readily may compete injuriously with infant pastures for light and nutritive materials, generally the most successful pasture establishment takes place when the pasture is sown alone. Should it be considered advisable for a special purpose to grow a companion crop, the rate of seeding of the latter should be substantially less than if it were to be grown alone—the heavier the companion the more severely is the young pasture likely to suffer. And the longer the young pasture is subjected to competition from a companion crop the more is it likely to suffer; hence cereals sown with pastures should be utilized for silage or chaff rather than for grain. This is of especial importance in the drier districts, in which the drain of the cereal on the summer supply of soil-moisture may prove very harmful to the young pasture. Because of the danger of injury associated with them the use of companion crops is more undesirable with seed mixtures intended to produce permanent pastures, which, because of their longer life, reflect any setback for a greater period.

In the spring establishment of pastures harm at times results from sowing too early while the severe conditions militate against vigorous growth from the outset and thereby lead possibly to stunting of growth and to increased trouble from weeds if they do not lead to the loss of valuable seedlings, such as those of clovers.

The application of phosphates to young pastures at or shortly after the time of sowing is usually advisable economically. There is some evidence that the use of sulphate of ammonia on newly established pasture may deleteriously affect the establishment of clover. If the soil is known to benefit from liming, then the use of lime at the time of the sowing-down of a pasture may be expected to be advantageous. In some districts established pastures undoubtedly benefit from applications of potash, but whether the application of potash at the time of pasture-seed sowing is advisable has not yet been ascertained by the Department of Agriculture.

Management of Established Pastures.

Top-dressing of established pastures in September may be expected to bring about increased growth, but whether such top-dressing is advisable depends upon not only an increase in yield, but the necessity for such an increase. If the increase in yield merely adds to a supply of feed adequate for all requirements up to Christmas, including ensilage and haymaking, then September top-dressing is not likely to be advisable—it would probably be better to defer the top-dressing until late summer. But if the top-dressing to date may not allow adequate reserves of hay and silage to be

secured, then September top-dressing may be well justified. Generally, areas to be closed for silage or hay should be top-dressed just before they are shut up, if fertilizer has not been applied to them fairly recently. All material, such as wire, timber, &c., likely to cause delays or breakages in mowing should be removed at the time of closing up the fields.

Probably in September some pastures still require harrowing ; usually further delay in the harrowing of pastures in which stock have fed during the winter is harmful. Further, fields to be utilized for hay or silage during the coming summer should be harrowed thoroughly just before they are closed from grazing.

If pastures suffering from the ravages of grass grubs are not so extensively damaged as to be beyond repair, then, as far as practicable, the feeding-out of hay, roots, and silage should be carried out on them. The feeding-out of hay made from overmature material is likely to be particularly useful in this respect, as it often contains viable seeds of valuable pasture species, and these seeds may substantially strengthen a weakened open sward. When the greater portion of the valuable plants in arable grassland have been destroyed by the grass grub, then usually the best course is to plough the land as the initial step towards the eventual resowing of it. In this connection it is well to bear in mind that grass or cereal crops cannot with safety follow a crop in which there has been considerable grass-grub infestation Further general information relative to the grass grub and its control is contained in Bulletin 159, which the Department supplies free on application

Pasture-seed Mixtures.

In recent years valuable advances have been made in the knowledge relative to the composition of pasture-seed mixtures As the advice offered to farmers frequently ignores these advances, farmers should take the necessary simple steps to assure themselves that the seed mixtures they use conform with the best available current knowledge. A common weakness relative to pasture-seed mixtures originates in false economy, which is grievous, because it begets an initial weakness which leads to a reduction in returns enduring probably as long as the pasture itself. One of the matters involving serious false economy is the use of inferior strains of such important constituents of permanent pastures as perennial rye-grass, cocksfoot, and clovers Reliable supplies of seeds of superior strains are made available by the official seed-certification measures. Each year becomes marked by increased evidence that even at the higher prices it is true economy to use certified seed in the establishment of permanent pastures. For general use seed belonging to the cheaper "permanent pasture" grade is eminently suitable, but when the production of certified seed is contemplated, then the use of "mother" grade seed is essential. It is unquestionably false economy to use seed poor in respect to germination or purity—in fact, it is but ordinary common sense to ascertain the guaranteed purity and germination capacity of all seeds purchased, including certified pasture seed , lines of certified in common with those of uncertified seed are likely to vary considerably in germination and to some extent in purity. Sometimes farmers lower their outlay by unduly reducing the amount of cocksfoot used. This may be due in part to the fact that the amount of cocksfoot used for permanent pastures in the past often has been too small. Widely in New Zealand, including land on which one should aim to build up a sward in which rye-grass and white clover are prominent, cocksfoot is of outstanding value from December onwards in providing feed during the summer period, in which rye-grass and other useful species make but scant growth. At times the tufty habit of cocksfoot has been intensified by the small number of plants in the pasture due to the use of insufficient seed. Generally the minimum amount of cocksfoot that should be used is 10 lb. an acre, and the amount that may be used advantageously

rises to 15 lb. for conditions more suited to cocksfoot than to rye-grass—*e.g.*, in dry conditions on the east coast of both Islands, apart from fields in which the production of rye-grass seed is an important consideration. Detailed information about seed mixtures for specific purposes and conditions is available from local officers of the Fields Division. The composition of various typical mixtures suitable for conditions obtaining in extensive portions of the Dominion is given in these notes in the February *Journal.*

Provision of Special Feed.

Associated with grassland, a most valuable source of cheap feed, is a weakness of basic importance. This weakness lies in the fact that in late summer and again in winter and early spring the production of feed from grassland declines sharply. While this fact is well known, the practical measures necessary to remedy the difficulties it creates are frequently neglected. In dairying, pastures often begin to prove inadequate from Christmas onwards, and, frequently with unfortunate results, feed provision seems to be based on the belief that this does not happen until February. Good management designed to keep the pastures leafy may delay to some extent the feed-supply becoming inadequate, but, even then, the summer feed shortage often occurs on dairy-farms earlier than the supplementary feed becomes available to meet it. Even though the summer feed from pastures is adequate in quantity, it is likely to be lacking in quality—too woody or fibrous, and consequently too indigestible and too poor in mineral matter. In the warmer districts the position may be remedied by crops of green maize and millet, provided they are consumed in the young leafy stage Soft turnips are so highly digestible that they are of outstanding value, particularly if, as so often happens in summer, grass or other feed, such as green lucerne, has been allowed to become somewhat mature and woody The aftermath on pastures cut early for silage or hay is also apt to give useful supply of summer green feed when that available from the fields under grazing is becoming undesirably scant

For use in the winter period mangels, carrots, chou moellier, swedes, and turnips are all suitable, and could profitably be grown much more extensively Except in the more severe and Southern districts, mangels give very attractive returns when accorded good fertility and good cultivation Being practically free from attacks of any serious disease and able to withstand dry periods relatively well, they are very reliable; and when suitably treated are characterized by heavy yields an acre of nutriment. Swedes and turnips may suitably replace mangels when the good treatment advisable for mangels cannot be readily provided. Carrots are suited to free, fertile soils, on which, as has been thoroughly demonstrated in Taranaki farmers' competitions, really attractive yields can be obtained. Chou moellier has rightly become popular in recent years for use on good ground, and especially on ground that is likely to be so wet at the time of feeding off as to make the satisfactory use of swedes somewhat difficult. Chou moellier, because it is distinctly resistant to club root, is also suitable when the ravages of this disease are at all likely.

Consideration of the crops to which reference has been made is opportune, because, in general, cultivation for all these crops should soon be in progress if it has not already commenced.

Another crop that specially calls for consideration at this period is lucerne. Lucerne is of outstanding value as a source of feed for use when the feed directly available from grassland is below requirements: the first cut converted into silage and other cuts possibly into hay provide excellent feed for winter use, while even in very dry seasons successful stands of lucerne usually provide substantial amounts of highly digestible green feed at a time when there is special need for such feed. Reference to the management of lucerne at this season was made in these notes last month.

Ensilage.

In recent years ensilage has rightly become so popular that there is now a much smaller need for general information about either its role in our farming or its manufacture, but there is still scope for its profitable extension for the purpose not only of building up reserves of feed to be used during critical periods of pasture shortage, but also of controlling pasture growth more efficiently in November and December. At times silage may usefully be fed to stock in September. In the case of cows in milk two facts should be kept in mind—

(1) Silage as commonly made, by itself, does not constitute a ration which allows cows of heavy yield to produce to their maximum capacity; this is because of the amount of woodiness which commonly characterizes the material from which silage is made.

(2) In the feeding of silage to cows in milk some care must be taken to obviate tainting of the milk; silage should not be kept close to the place of milking or of storing of milk and cream; the person or clothing of milkers should not be permeated with the odours of silage. Experience has shown that simple precautions of this nature eliminate all risk of dairy-produce developing silage taints.

Cultivation Work.

In view of the fact that August is usually an extremely busy time in respect to cultivation operations, it is advisable to bear in mind that often more harm than good may result from the working of wet soils. Just how wet a soil may be cultivated without injury depends to a considerable extent upon the nature of the soil—sandy soils may be worked practically at any time, while great care must be taken not to work, when they are too wet, soils in which clay is a prominent constituent. Frequently old grassland may be ploughed with safety when adjacent land, similar except that it has been under the plough for some time, could not be worked without injury to its texture. Usually the cultivation of land which is so wet that it adheres to boots and implements does not prove fully satisfactory.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Cultivation.

SPRING may be regarded as the commencement of the busy period of each season's orchard activities, therefore orchardists are recommended to bear this fact in mind and plan ahead the necessary work to be carried out, with a view to completing each operation in its proper season. In fact, successful orchard management can be achieved only by following this practice.

It is presumed that the winter operations as outlined in previous notes in this *Journal* will have been completed. The main activities for the coming months will be confined to cultivation, spraying, manuring, grafting (where necessary), thinning, and finally the harvesting and packing, &c., of the next season's crop.

The importance of thorough cultivation carried out in its proper season cannot be overstressed, and orchardists in their own interests should pay as much attention to this work as to spraying, &c., because fruit-trees will not thrive unless the roots have a free run in sweet soil.

Under the heading "Cultivation and Manuring," in the May notes, it was recommended that autumn or early-winter ploughing be carried out by throwing a furrow up to each row of trees, thus bringing the finishing furrow, which acts as a temporary drain, midway between the rows of trees. This ploughing should be followed up as early as soil conditions will permit in

the spring by striking out a furrow midway between the rows of trees, thus filling in the finishing furrow or temporary drain formed by the autumn ploughing. It is advisable to plough up to within a reasonable distance of the trees, and the plough should be reduced to a depth that will avoid cutting and damaging tree-roots. At this ploughing set the plough to a depth which will avoid turning up any green matter or manure which may have been ploughed under during the autumn. The land about the trees untouched by the plough should be dug or grubbed, and all vegetation turned under. After ploughing, the soil should be brought to a fine tilth, as soon as possible, by means of disks or harrows.

The third and final ploughing for the season should be done as early as possible in September, when the orchard may be cross-ploughed at about the same depth as the previous ploughing. It is recommended that each day's ploughing should be harrowed the same day in order to eliminate the risk of excessive drying-out of the soil where such is likely to occur. Subsequent cultivation will consist of harrowing, &c., which should be continued until about the end of January.

Manuring.

Nitrogenous fertilizers, such as sulphate of ammonia, nitrate of soda, &c., may be applied about the beginning of September, or when signs of growth movement become apparent. Care must be taken, however, not to apply too heavy a dressing—generally a dressing of 1½ lb. to each tree may be considered a liberal one.

Grafting.

The reworking of trees by grafting may be undertaken at any time from the "green tip" period to about the middle of October. The scions require to be kept in a dormant condition. If the trees to be grafted were previously cut back for grafting, it will be necessary, just prior to inserting the scion, to make a fresh cut. To insure a good "take" make clean cuts, bind scion to stock carefully with raffia, apply grafting-wax or other suitable preparation to protect the exposed tissues from drying out and to prevent rain-water from gaining access to the graft until the scion and stock have united. For detailed instruction relative to this matter see Vol. 47, No. 2, page 122, of this *Journal*, August, 1933.

Seasonable Spraying.

At time of writing, indications point to an early spring, therefore growers are advised to anticipate this occurrence by having the spray pump and materials in readiness for spraying. The following may be taken as a general guide for the various normal growth movements of pome-fruit trees: Tight cluster stage, about 20th September; pink cluster stage, about 7th October; petal fall stage, about 19th October; calyx closes stage, about 30th October.

—*J. W. Whelan, Orchard Instructor, Palmerston North.*

Citrus Notes.

During the next few months cultivation will be an important part of the operations in a citrus orchard, and every reasonable attention should be given to this work. Cultivation of the soil has several advantages, and should be carried out in an intelligent manner in order to obtain the best results. Some of the advantages of cultivation are:—

(1) It prevents evaporation by reducing the conductivity of heat and also by breaking the capillary tubes in the soil through which the subsoil moisture escapes.

(2) By letting the air into the soil, it enables the beneficial bacteria to work more fully.

(3) The finely cultivated surface absorbs and retains any moisture that may fall, and during periods when the rainfall is limited this is of great importance.

(4) It is a means of keeping down weed growth, which, during the spring and early summer, is not beneficial to the trees.

There are perhaps some growers who do not understand how moisture can be conserved by cultivation. Turning over the soil on the surface certainly causes it to become drier and gives the impression that the operation only assists the moisture to escape. However, the fact is that the broken layer on the surface acts as a blanket through which moisture can only escape slowly.

Whether cultivation should be shallow or deep is a matter for individual judgment, depending largely upon the nature of the soil and the depth of the roots. Where soils are somewhat heavy, cultivation should be deferred until the soil is in a suitable condition. However, where the soil is of a sandy nature the same care is not necessary, as there is little danger of packing either the soil or subsoil.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Seasonable Reminders.

It may be well to reiterate that the end of next month, or, at any rate, early October, may generally be regarded as the end of the correct season for hatching out chickens. Even with the lighter breeds, such as Leghorns, the birds will not lay till the spring if brought out later than the end of September. It is always better to hatch out somewhat early rather than somewhat late Remember that the laying year ends with the moult, so that the late hatched birds have no opportunity, having regard to the short season available, of producing a good egg-yield during the pullet year. Not only do they lay during the season of cheap prices, but they are likely to involve one in constant trouble with disease and parasitic infestation, and, further, they never make good breeding-stock.

There is yet ample time to hatch out ducklings for the renewal of the laying flock, but early September should see all the eggs undergoing the process of incubation for the production of ducklings for the Christmas market. To cater for this trade, the eggs should be put down about fifteen weeks before the young birds are to be marketed This will allow twenty-eight days for hatching, the natural time, and the remainder for rearing the birds to prime condition. It is always a wise course, whether it be with table ducklings or poultry stock intended for the Christmas trade, to market the birds at least a few days before the festive season sets in. In this way those poulterers who cater for the best trade are given an opportunity of preparing the birds for market, and placing them in the freezer to await the rush. A point in regard to ducks is that they should be mated some time before the eggs are required for hatching purposes, or a high percentage of infertile eggs may be expected. Ducks, particularly the heavy breeds, usually have to be mated much longer than fowls in order to secure a high percentage of fertile eggs.

Feeding Chickens.

A correspondent who paid a visit to the Wallaceville Poultry Station during last Christmas week, in expressing his appreciation of the condition and general appearance presented by the chickens of various ages seen in the process of being reared, is anxious to know how the young birds were fed. Mr. H. A. Kitto, the Overseer, has furnished me with some details

regarding his method of feeding from the time the chicks are placed under the brooder until a matured age is reached, and particulars are given below.

While proper temperature, ventilation, and cleanliness are among the chief factors in raising brooder chicks, the matter of providing the right class of food is also imperative, and must not be overlooked. Numerous mixtures have been tried at this Station. Experience goes to show that the main point is to feed nothing but sound wholesome food, and that the manner in which the food is supplied is almost as important as its quality.

During the past two seasons a plain, simple ration, without the addition of any prepared mixtures, condiments, stimulants, &c., was provided, and this gave highly successful results.

The chicks are transferred from the incubator to the brooder after dark. The following morning, say, from thirty-six to forty-eight hours after hatching, they receive their first meal. For the first eight days the required food is taken from the following mixture. Finely broken wheat, 70 lb.; finely broken maize, 20 lb The chicks are fed three times a day—viz, in the early morning, mid-day, and about one hour before dark. At first only a few minutes are allowed the chicks to feed. The food is provided on flat trays with low sides, the trays being removed as soon as the chicks appear to be satisfied. Special care is taken not to overfeed the chicks during the early stages, particularly during the first week. It has been found a good plan to slightly underfeed rather than to overfeed during the early stages The required quantity of mixed dry broken grains it is intended to feed daily during the early brooder stage are placed in a basin, slightly moistened with hot water or milk, and allowed to steam some time before being fed, a plate being placed over the basin to keep the steam from escaping This causes the grains to swell, and thus prevents them doing so in the chick's crop. Fresh clean water is made available to the chicks to drink when provided with their first meal, and is left before them at all times for the first four days. From then onwards fresh or skim milk is used in place of water and left before the young birds at all times during the brooder stage, which generally lasts from six to eight weeks according to prevailing weather conditions From the eighth day to the eighth week a mash is provided for the morning and mid-day meals, a broken-grain ration, as referred to above, being fed in dry form for the evening meal. The mash is made up of 2 parts wheatmeal and 3 parts bran, moistened with sour milk and mixed to a crumbly condition but not sloppy. After the eighth week and until the pullets show signs of nearing a laying-point a mash mixture is fed for the morning and midday meals. This consists of wheatmeal, 2 parts, pollard, 1 part; and bran, 3 parts; moistened as before described.

A grain mixture as follows provides the evening meal: Wheat (whole), 2 parts, shelled oats, 2 parts; barley (hulled), 2 parts, maize (broken), 1 part. When it is observed that pullets are showing signs of prematurity, say, at about four months old, and in order to check this, the use of milk for moistening the morning mash and as a drink is reduced by degrees by way of adding water thereto until milk is eliminated from the ration, only hot water being used for moistening the mash, and cold water given as a drink. When the great bulk of the young birds commence to lay they are given a ration similar to that given to the adult laying flock. The morning and noon meals consist of mash made up of wheatmeal, 3 parts; pollard, 2 parts; bran, 4 parts; each by measure; to which from 5 per cent. to 12 per cent. by weight of the entire mixture of meatmeal is added, according to the birds' laying condition. At this stage the ingredients of the mash are generally moistened with hot steamed lucerne. For the evening meal a grain ration as follows is fed: Barley, 6 parts; wheat, 2 parts; maize, 3 parts. The manner in which the birds appreciate the different kinds of grains is always taken into consideration, and when it is

observed that they are leaving any particular grain and showing a disinclination for it, this is provided in reduced quantity. When the birds become settled down to egg-production, meatmeal, in addition to that included in the mash, is placed in a hopper and left before the birds at all times to pick at as they choose. Right from the start stone-grit, broken oyster shell, and charcoal are always in front of the little birds. The important point of keeping the chicks well exercised throughout all stages of their development is not overlooked. This is induced by scattering some broken wheat, &c., in the litter and making the chickens scratch and hunt for the grains. Another way of inducing exercise is to tie up some green material sufficiently high to make the chickens jump to secure it. For the first week green food such as finely cut silver-beet, green oats, &c., is fed in combination with the moist grain ration, the former being merely sprinkled over the latter. From the end of the first week onwards green material is fed separately and in abundance—viz., for the first meal in the early morning, again at about 2 p.m., and after the grain ration provided in the evening. Special care is taken that all green material fed is tender and succulent, and not coarse or hard fibrous growth. If chicks are supplied with long pieces of fibrous substance when very young, it is apt to become a tangled mass, and will not leave the gizzard, with the result that death is likely to take place. All grains are broken or ground into meal as the case may be on the plant, and to a size suitable to the age of the chickens to which it is to be fed.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Breeding.

COLONIES in normal condition should now have a good quantity of sealed brood in the combs, and young bees emerging every day. The queens should be laying well, though not up to their full capacity; but their powers in this direction will increase with the approach of warmer days. The first bees bred this season will act as field-bees, and the older autumn-bred ones will die off rapidly. Breeding should be kept going steadily without a break, as it is necessary that each colony should grow in strength in order to be in a condition to take advantage of the first flow from the early nectar-secreting plants.

Food and warmth are the main factors in promoting steady breeding, and these should have constant attention. It is well to remember that when breeding is in full swing a considerable amount of food is used up every day for feeding the brood. All through the spring when weather conditions are favourable some nectar can be gathered, and often a considerable amount, which helps to supplement the stores in the hive, is stored. However, there are times when, through bad weather, the bees are unable to do this. Where such conditions last for several days the food-supply will diminish rapidly, and the bees may be reduced to starvation before the beekeeper is aware of their condition. August and September are critical months in this respect, and if a spell of bad weather is experienced it is well to ascertain the condition of the food-supply in each hive, and feed without delay where necessary.

Hints to Beginners.

There are a few points which every beekeeper should bear in mind when starting an apiary. The stocks must be clean and in good condition. No beekeeper can hope to succeed with poor bees, and no one but a novice would tolerate other than strong colonies. The hives should be well made and painted; cracks and knot-holes may be of use for ventilation in the

summer, but at any other time of the year they absorb much of the bees' time in gathering propolis to stop the draughts; moreover, any holes besides the entrance offer an inducement for robbers to investigate, and necessitate the bees employing extra guards to prevent attack. A careful watch should be kept on the stores, so that the bees may not starve. It is far better to overfeed than underfeed, for, as already indicated, it is amazing how quickly a colony will deplete its stores when brood-rearing commences in the spring. More feeding means more brood, but, once commenced, it must be continued until the hives show actual proof that they are gathering sufficient nectar to keep themselves going. Feeding should be done only in the evening, inside the hives, and it is advisable to use a syrup in the proportion of 2 parts water to 1 part sugar, to dissolve it thoroughly, and feed it as soon as it has cooled sufficiently to be harmless to the bees.

It is well to provide permanent shelter, a live hedge is the best if kept trimmed to a height of 8 ft. or 10 ft., failing this, some kind of breakwind is essential. The hives should never be exposed to high winds, as, in addition to the danger of the roofs being blown off, cold draughts check brood-rearing to a very great extent.

The hives should be opened only on warm, still days, and necessary observations made and noted as quickly as possible. The inside of the cover makes a good rough diary, and does not get lost or mislaid; mark the date of each examination. One should endeavour to distinguish the sex of the brood at a glance, and keep a sharp lookout for the queen; she is easily distinguished by the length of her body and the comparative shortness of her wings. An effort should be made to make a rough estimate of the weight of each frame as it is lifted by comparing it with that of an empty comb and thereby arriving at some idea of the quantity of stores in each hive. It is unwise to try to run many hives until the rudiments of the business have been grasped—it is well to be content with one or two strong colonies until the learner's stage has been passed.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

ON sandy lands by the seashore, sea-kale is a perennial crop that is easily grown; such localities in Europe are its natural home. As the crop is harvested in the spring, it is of special value, as there is usually but little variety at that season. It may be grown from seed or root cuttings. Seeds may be sown now in rows 1 ft. or so apart and the plants thinned to a distance of 6 in.; they will then be ready for planting out permanently after twelve months' growth; this is done at a distance of 2 ft. between plants and 2½ ft. between the rows. Root cuttings give a quicker return; they are made from pieces of root about the thickness of a pencil and about 4 in. or 5 in. long. It is convenient to cut the tops square across and the lower end with a slanting cut. These should be planted out now in rich ground well prepared in an open position, where the crop should produce well for five years or more. The top of the cutting should be 2 in. below the surface of the ground. A number of growths will appear from each cutting, but all should be removed except the strongest. Occasional applications of nitrate of soda will bring the plants along strongly. The crop has a fairly wide range of adaptability, and need not be confined to the localities mentioned. When planting out seedlings now the crown of the root must be cut off or the plant will produce a flower stem, which should never be allowed. A number of growths from the one plant will develop, but they should all be removed except the strongest—as is done with root cuttings.

The plants die down in the winter, when the beds should be cleaned up. Before growth recommences in established beds, each plant should be covered with a box or pot to exclude the light: a tender blanched growth 8 in. or 10 in. long is the result. This always should be cut with a portion of the crown of the root, and the plant then allowed to grow naturally, the shoots being thinned, leaving only one or two of the strongest to complete its growth. To do this satisfactorily a good dressing of manure should be applied and worked in during early summer.

A dish of moderate-sized leeks well grown has very much the flavour and attractions of good asparagus. It is a very hardy crop and subject to very few troubles of any kind. It is a reliable crop in fairly rich land in any climate. To produce plants for setting out towards the end of the year in land from which an early crop has been cleared a generous sowing should be made now.

The most delicious of the cabbage family are the Brussels sprouts, and very fine crops are now being grown here in the cooler districts. As they require rather a long season to complete their growth, they are sown thinly towards the end of September, and planted out about the month of November in a piece of ground which has been well manured and cultivated and from which an early crop of peas, &c., has been taken. To obtain the firm solid sprouts that are desirable good thrifty growth is necessary, and this is obtained by planting them out in ground that has become consolidated and has not been recently dug. An application of nitrate of soda or sulphate of ammonia may be made when the plants have become established, but it is to be remembered a too generous application of manures will be detrimental.

The popularity of green peas demands a generous supply, to maintain which a sowing of a mid-season variety should now be made. A rich, moist soil in which lime and phosphates have been included suits them best.

Main crop potatoes are usually planted during the months of September and October. While a rich, light loam is most suitable for the crop, it is often planted in rough land newly broken in, with a view to cleaning it and bringing it to a fine tilth. For this purpose the potato crop is very suitable. Rough dirty ground is quite unsuitable for fine seeds, and, while it may not grow a heavy crop of potatoes, a potato crop will be as good as can be expected and equal to or better than any other that might be obtained from land in that condition. In addition, the hoeing, moulding, and digging will aerate and sweeten the land as well as destroy the weeds. It is for these reasons that the crop is popular for assisting in breaking in new lands.

The fundamental requirement of successful cropping of any kind is good seed. This is more than usually difficult to obtain in the present case owing to degeneracy, bad storage, or disease. Virus disease especially is dangerous, as infected tubers may not show the least sign of it. In the absence of known reliable stocks it is best to obtain potato seed certified by the Department of Agriculture after careful examination during the growth of the crop and at the time of digging. Whole seed is safest to plant but large tubers may be cut so long as each piece has one or more strong eyes. Cutting also permits a more thorough inspection, which is an advantage with doubtful seed. Cut seed should be sown at once; if this is not possible spread cut seed on a floor and cover with wet sacks. On small areas planting may be done as digging proceeds; on larger areas the land is sometimes marked out with a sledge or other marker and the tubers set with a hand planter or grubber; more usually in such cases the seed is ploughed in about 4 in. deep. A practice too frequently followed is to allow the crop to take care of itself after sowing until the plants are well above the ground and a strong crop of weeds is established. Better growth and clean ground will be secured by harrowing the land about a fortnight after planting, to break up the crust and destroy weeds, repeating

the operation as necessary until the potatoes are up. Then one deep cultivation between the drills should be given, followed by shallow working as may be necessary and gradual moulding-up, which should be completed as the crop commences to flower

In warm humid localities where early potatoes may be grown, but late crops are seriously subject to disease, kumaras are very good substitute for the latter They are grown from slips produced from tubers sprouted on a hotbed. After making up the hotbed and allowing it a few days to settle down, spread 1 in of clean sand, then sound kumara tubers close, but not touching. Then cover to a depth of 4 in. with clean sand or sandy loam. Water the bed thoroughly with a water-can, and keep it moist, but great care is necessary in this, and it is safer to keep it rather on the dry side In four or five weeks the tubers have sprouted, and when the shoots are 6 in in length they should be removed carefully. At this stage they should have sufficient roots to sustain them. They should then be heeled closely, in a well-sheltered sunny position, and provision made so they may be readily covered should there be any danger of frost Here they harden off and make root in readiness for planting out from the middle to the end of November. A sandy loam well sheltered is ideal for planting out this crop.

As the value of fresh salads is now generally appreciated, radishes and lettuce should be sown And for those who appreciate a variety of vegetables salsify may be sown 1 in deep in rows 15 in apart. It has few enemies, and provides a generous crop of roots for winter use

Where interest is taken in herbs, seeds of coriander, caraway, angelica, dill, aniseed, summer savory, and sweet marjoram may be sown, the latter must be treated as a half-hardy annual, the remainder are quite hardy Cuttings, with a heel of old wood, of sage, rosemary, lavender, and thyme may be taken and rooted in a moist sandy soil Spearmint, peppermint, tarragon, and chives may be propagated by division.

Tomatoes and other half-hardy crops sown in boxes which are placed on a hotbed towards the end of August should be pricked out into other boxes as soon as they are big enough to handle No artificial manure should be used with the soil, if it is poor a little fine bone-meal may be added. The boxes of seedlings should be returned to the hotbed and watered with tepid water through a fine rose. When the plants are established it is advisable to ventilate freely in fine weather and encourage steady growth in moderate temperatures.

Tomato Crops under Glass.

In the unheated glasshouse this crop requires close attention at the present time owing to the changeable weather. Much has been said about the need of ventilation and a dry atmosphere for this crop under glass, but the remarks apply chiefly to the early summer period when the house is crowded with growth. There is little danger from excessive humidity now, and a cold draught may seriously retard the crop During the springtime ventilators must be adjusted with every change in the weather so that steady growth is maintained, and when late frosts threaten a few heaters of some kind should be at hand to meet the emergency It is advisable to avoid forcing growth when the lower bunches are setting, and to assist them, if necessary, by jarring the strings on which the plants are trained, by rapping them smartly with a light cane or by drawing the cane quickly along the rows of twine, this should be done about noon in fine weather. Shallow cultivation to break up the surface crust and destroy weeds is beneficial, and tepid water should be applied during the morning as required. Sturdy plants with plenty of blossom is the object in view; rank, soft growth, and poor setting is often due to high temperatures, excessive watering, and a loose rich soil.

Small-fruit Crops.

Light cultivation to destroy weeds and encourage growth should be given as may be necessary. Deep cultivation must be carefully avoided at

this season or irreparable damage will be done to the fruit crop. Established plantations from which heavy crops are expected will generally benefit from a dressing of fertilizers worked in about the time growth commences.

The planting of all hardy crops of this class should now be completed at the first opportunity during fine weather. Those crops which are inclined to be rather tender during the early stages of growth, such as passion-fruit, tree tomatoes, and Cape gooseberries, may be planted towards the end of October.

The Homestead Garden.

New lawns should be trimmed as soon as the grass is long enough for cutting; use a mower that is in good order and set it high, generally as high as possible. Cut the lawn when the grass is dry and afterwards roll it with a light roller. When old lawns become thin and weedy it is usually due to a lack of fertilizing treatment. Applications of 3 parts sulphate of ammonia and 1 part of sulphate of iron are a popular dressing to suppress the weeds, but it is also necessary to manure the grasses and obtain a vigorous growth, when weeds will have little chance of again becoming established On light land a rich dressing of complete manure of organic origin is most suitable. It should be in a dry friable condition so that it may be easily spread and may quickly work down to the roots of the grasses. On heavy land the dressing may be composed chiefly of artificial fertilizers well mixed with sharp sand. Early spring is the most suitable time for making these applications.

Rose-pruning should now be completed. Cut away the weak wood on young plants and shorten the remaining growth to 3 in. or 4 in., cutting just above buds that are pointing in an outward direction. This is considered destructive by those who are unaccustomed to the work, but it will not be long before the treatment is justified by growth far exceeding that on bushes of the same age which have been pruned lightly. The bushes also will be more shapely, besides having other important characteristics.

Prick off half-hardy annuals out of seed-boxes, setting the young plants down almost to the seed leaves. Firm the roots in the ground, but not the stem at the surface; it is very tender and liable to serious injury.

The decorative character of many pot-plants make them very desirable ornaments at times; they are also most economical if they are used understandingly. Palms, *Begonia rex* varieties, aspidistras, asparagus species, and ferns dislike much sun, and should be given shady situations. Warm sunny positions are suited to geraniums, pelargoniums, and members of the cactus group. All pot-plants soon show signs of distress if fresh air is lacking, and cold draughts are equally injurious. The water used should be of about the temperature of the atmosphere, so it is often advisable to "take the chill off" in cold weather. Where potting or repotting is necessary, it is generally best done about the month of September. It is usually done satisfactorily, but improvement may sometimes be made by seeing that the roots of the plant to be operated on are moist, but not very wet. The plant should be repotted a day or two after watering. After setting the plant in a fresh pot, water it in, but withhold water afterwards until growth recommences and more water is obviously required. Results depend very much on the soil mixture used; most of the plants above mentioned require rather a rich soil with plenty of humus (decaying organic matter, chiefly vegetable, such as leaf-mould) and sand to keep it open and prevent it setting hard. Equal parts of good loam, leaf-mould, and sand will suit most of those above mentioned; with the addition perhaps of a little fine bonedust. Where the soil is light, it is usually advisable to increase the loam ingredient and halve the quantity of sand used. Geraniums and pelargoniums should be potted firmly in a soil composed of 3 parts good loam, 1 part decayed manure, a little coarse sand, and rather generous addition of bonedust.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: JULY, 1934.

Dominion Meteorological Office.

DURING July there was a predominance of southerly winds, but except for those on the 4th, 17th, and 27th, they were usually not severe. The month, however, was a cold one.

Rainfall.—Rainfall distribution during the month was somewhat irregular. The greater portion of the country experienced less than the average amount, the largest deficit being in Canterbury, where, at places, less than half the normal fell. North Auckland, Otago, and Southland, and districts about Cook Strait, on the other hand, had considerably more than the average.

Temperatures were everywhere below the average. In the North Island the mean difference was 1°·5 below, the recording station showing the greatest difference being Taihape, where it was 2°·2 below. The South Island mean was 1°·9 below average, Christchurch and Hanmer Springs having the largest departures, with 2°·8 and 3°·8 respectively The low mean temperatures are accounted for by the prevalence of southerly winds and the unusually cold night temperatures in the clear weather accompanying them. Frosts were frequent, some inland places in the South Island experiencing the most severe ever recorded.

Sunshine.—Fortunately there was more sunshine than the average at most places, New Plymouth being the only one with a deficiency Blenheim had the highest total—viz , 195·9 hours—while Nelson had 191·6 hours and Tauranga 163·7 hours.

Pressure and Weather Systems.—The storm systems during July were somewhat similar in type to those ruling in June with a tendency for the areas of lowest pressure to pass over the North Island.

The disturbance, which was responsible for the widespread snowfall at the end of the previous month, was on the 1st July still located east of New Zealand, By the morning of the 2nd, a secondary depression had formed west of Cook Strait, and during the night of the 2nd it passed over the North Island The southerly, consequently, continued to be severe during the following two days, much snow falling in both the North and South Islands.

On the 7th a cyclonic depression which had, during the previous two days, been centred off the New South Wales coast, was covering the greater part of the Tasman Sea. Its effects were already being felt from Canterbury northwards, strong north-east to east winds being accompanied by widespread rains Very heavy rain fell in the North Auckland District on the night of the 7th, totals of over 5 in being recorded at some places for the twenty-four hours preceding 9 a.m. on the 8th As a result, there was some heavy flooding. The storm had disappeared eastwards by the morning of the 9th, and, owing to the development of an intense depression over south-eastern Australia, the southerly in its rear was quite a mild one.

Other depressions causing fairly general rains crossed the Dominion on the 16th, 21st, and 27th respectively. The two former were of the westerly type, but the one on the 27th was a complex one with a centre which crossed northern New Zealand. Heavy rain was associated with it in North Auckland and strong north-east to south-east winds blew.

Most of the disturbances referred to were responsible in their later stages for snowfall on the ranges, while at the beginning of the month and again on the 16th a considerable amount fell on the low lands. Canterbury received a fairly substantial coating during the night of the 16th, when a boisterous southerly prevailed.

Interspersed with the storm areas mentioned, there were various though brief periods of fine weather associated with passing high-pressure systems. For instance, it was fine generally from the 5th to 6th, 13th to 14th, 17th to 20th, on the 25th, and during the last three days of the month.

RAINFALLS FOR JULY, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.	Total for Year to Date.	Average for Year to Date.
			North Island.			
	Inches.		Inches	Inches.	Inches.	Inches.
Kaitaia	8·44	17	2·96	5·48	33·93	33·64
Russell	10·22	15	4·83	5·27	43·01	32·60
Whangarei	8·75	17	4·73	7·19	37·33	38·79
Auckland	5·97	19	2·42	5·06	32·78	27·05
Hamilton	5·99	21	2·13	5·10	27·87	29·00
Rotorua	5·25	13	2·82	4·98	32·60	31·85
Kawhia	3·66	16	1·00	6·01	30·61	31·55
New Plymouth ..	4·96	22	1·70	6·39	31·33	34·85
Riversdale, Inglewood ..	9·04	20	1·85	10·06	47·49	58·71
Whangamomona ..	3·75	9	1·07	7·27	37·66	42·97
Hawera	3·42	14	0·59	4·22	24·50	25·61
Tairua	5·33	9	2·50	6·31	33·74	39·87
Tauranga	4·63	14	2·64	4·89	33·46	31·57
Maraehako Station, Opotiki	3·81	11	1·11	4·45	27·61	32·24
Gisborne	4·29	12	1·86	5·05	17·48	29·96
Taupo	3·26	13	1·10	3·87	25·87	25·23
Napier	2·39	12	0·68	3·81	18·70	22·52
Hastings	1·98	11	0·63	3·66	15·88	20·29
Whakarara Station, Kereru	4·23	8	1·60	..	31·73	..
Taihape	3·35	18	1·02	2·98	28·06	20·69
Masterton	3·50	17	1·38	4·20	20·46	23·03
Patea	3·20	16	0·65	4·23	24·10	25·63
Wanganui	2·34	17	0·53	3·34	21·04	21·04
Foxton	4·39	11	1·65	3·11	20·45	18·38
Wellington	6·10	20	2·04	4·71	26·92	25·00
			South Island			
Westport	6·15	16	1·08	8·30	54·41	54·80
Greymouth	5·82	16	0·78	7·93	56·36	57·49
Hokitika	8·29	16	1·71	8·74	55·41	63·90
Ross	7·59	11	1·99	9·18	69·00	71·95
Arthur's Pass ..	7·93	5	3·30	9·93	85·23	85·87
Okuru, South Westland	7·58	9	2·00	10·52	..	82·56
Collingwood	10·88	14	5·05	9·40	50·69	54·96
Nelson	3·81	9	2·25	3·46	20·45	21·76
Spring Creek, Blenheim	2·94	11	1·95	3·42	16·68	17·89
Seddon	3·13	8	1·00	2·40	16·34	14·72
Hanmer Springs ..	3·34	8	1·90	4·37	34·45	25·98
Highfield, Waiau ..	2·05	4	1·16	3·34	23·27	20·08
Gore Bay	1·65	5	0·60	2·80	24·60	18·67
Christchurch	1·25	12	0·51	2·67	17·81	15·60
Timaru	0·77	7	0·29	1·88	17·68	12·96
Lambrook Station, Fairlie	1·08	4	0·50	2·62	18·58	14·60
Banmore Station, Clearburn	0·81	10	0·30	1·74	14·56	14·54
Oamaru	1·96	7	0·55	1·72	14·83	12·70
Queenstown	2·47	11	1·07	2·02	18·56	17·30
Clyde	0·97	7	0·31	0·90	12·37	8·66
Dunedin	2·96	12	0·66	3·00	24·58	21·13
Wendon	2·63	15	0·65	1·74	18·54	17·22
Balclutha	4·17	17	1·00	1·78	21·99	14·49
Invercargill	4·51	22	0·61	3·28	26·46	26·45
Puysegur Point ..	7·47	27	0·49	6·15	41·12	48·41
Half-moon Bay ..	5·61	26	0·78	4·40	29·10	33·53

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WHEAT VARIETY TRIALS IN THE SOUTH ISLAND.

SEASON 1933–34.

Fields Division, Department of Agriculture.

IN the 1933–34 season twenty-nine wheat-variety trials were conducted in Marlborough, Canterbury, and Otago in collaboration with and on behalf of the Wheat Research Institute. The main project was the comparison of Cross 7 (Solid-straw Tuscan × White Fife), bred by the Wheat Research Institute, with Solid-straw Tuscan. Of twenty-six such trials laid down, twenty-five were harvested, while two out of three experiments in which other varieties were compared with Solid-straw Tuscan were harvested.

Most of these trials were laid down by the Beaven half-drill-strip method, at the suggestion of Dr. Hilgendorf, using farmers' drills. The arrangement of plots resulting was as follows : 1, 2, 2, 1, 1, 2, &c., where 1 and 2 represent the different varieties under trial, there being ten replications of each variety.

A standard rate of seeding of 2 bushels per acre of each variety was used. One hundredweight of superphosphate per acre was sown with the seed in all trials.

TRIALS WITH CROSS 7.

Milling and baking tests by the Wheat Research Institute have shown a fairly consistent and appreciable superiority of Cross 7 over Solid-straw Tuscan, and its yielding-capacity is the subject of further trials during this season. Its whole performance—yield, milling and baking qualities—will be reviewed by the Wheat Research Institute before supplies of seed are made available to growers. It is anticipated that seed will be available for next season's sowing.

Particulars of dates of sowing and harvesting and results of each individual trial in the 1933–34 season are given in Table 1. Observations during the growing period of the crops are summarized as follow :—

1. *Tallness.*—Generally, Solid-straw Tuscan was taller and more vigorous than Cross 7, more particularly in the early stages.

2. *Date of Maturity.*—Cross 7 ripened earlier than Solid-straw Tuscan in the majority of trials. No attempt was made to harvest each variety at its optimum stage of ripeness, and as harvesting was carried out when the later maturing variety was in fit condition the Cross 7 had, in most cases, been ripe several days when the crops were cut.

In Experiment 14 (for location, see Table 1) both varieties had ripened some weeks before being cut, as adverse weather conditions had prevented earlier harvesting, but no shaking occurred. The crop was cut and threshed on the same day.

3. *Lodging.*—In four trials (Nos. 1, 20, 21, and 22) it was reported that Solid-straw Tuscan showed a greater tendency to lodge than Cross 7. In trial No. 1 Solid-straw Tuscan was badly lodged in patches while Cross 7 was standing up well. In two others (21 and 22) lodging of the Tuscan would have been much more severe had it not been for the support rendered by the adjacent plots of Cross 7.

4. *Loose Smut.*—Cross 7 was reported to be more badly affected with loose smut than Tuscan in eight (8, 10, 16, 17, 18, 19, 25, and 26) of the trials, while in one experiment (1) this position was reversed.

Table 1.—Yield in Bushels per Acre and Differences from Solid-straw Tuscan in Trials with Cross 7

NOTE.—Differences in heavy type are statistically significant

Number and Location of Trial	Date Sown	Date Harvested.	Yield in Bushels per Acre.		Difference in favour of Solid-straw Tuscan (+) or Cross 7 (−).
			Solid-straw Tuscan.	Cross 7.	
1. Smith Bros., Tuamarina ..	18/5/33	4/1/34	43·4	59·1	15·7*
2. M. Walsh, Omaka	19/5/33	27/12/33	32·3	31·4	+0·9
3. G. R. Page, Glasnevin ..	20/6/33	20/1/34	11·2	10·7	+0·5
4. D. Morgan, Cheviot	23/5/33	19/1/34	56·0	49·7	+6·3
5. A. R. Hislop, Amberley ..	13/6/33	20/1/34	24·2	21·8	+2·4
6. K. L. Wilke, Culverden ..	13/6/33	17/1/34	21·2	23·6	**−2·4**
7. G. H. Cross, Oxford .. .	30/6/33	27/1/34	24·9	31·4	**6·5**†
8. High School, Rangiora ..	21/6/33	24/1/34	47·6	46·9	+0·7
9. C. Rands, Springbank ..	25/5/33	17/1/34	28·1	28·8	0·7
10. C. G. Amyes, Fernside ..	28/8/33	2/2/34	27·6	21·8	**+5·8**
11. F. Carpenter, Prebbleton ..	19/5/33	26/1/34	29·9	27·2	**+2·7**
12. R. T. McMillan, Irwell .	15/6/33	18/1/34	26·9	25·8	+1·1
13. D. Mulholland, Darfield ..	22/5/33	1/2/34	28·2	26·1	+2·1
14. W. R. Oliver, Hororata ..	9/6/33	25/2/34	34·5	38·2	**−3·7**
15. L. O. Oakley, Rakaia ..	20/6/33	1/2/34	32·7	32·7	0·0
16. J. Ruddenklau, Methven ..	26/6/33	5/2/34	37·5	42·3	**−4·8**
17. A. Amos, Wakanui .. .	16/6/33	27/1/34	34·3	32·9	**+1·4**
18. H. A. Harrison, Doric ..	13/6/33	2/2/34	24·6	19·7	**+4·9**
19. Mrs. Hall, Lyalldale	21/6/33	16/2/34	34·3	35·6	**−1·3**
20. A. B. Timblick, Hilton ..	14/6/33	14/2/34	27·5	25·5	+2·0
21. I. A. Marshall, Tycho ..	9/6/33	20/2/34	54·2	52·6	+1·6
22. J. C. Hay, Morven	10/6/33	15/2/34	57·7	52·0	**+5·7**
23. J. Newlands, Ngapara ..	9/8/33	24/2/34	55·5	62·1	**−6·6**‡
24. R. B. Paton, Pukeuri (A) ..	9/5/33	10/2/34	29·3	26·5	+2·8
25. R. B. Paton, Pukeuri (B) ..	18/5/33	10/2/34	28·0	25·9	**+2·1**
Lincoln College	..	..	44·8	43·4	+1·4

* Plots not threshed separately so that statistical examination was not possible. As stated in the text Solid-straw Tuscan lodged badly in places and a large amount of pinched and immature grain was left in the straw at threshing. Tuscan was also frosted to some extent.

† Although statistically significant, this difference may have been influenced by damage to stooks resulting from lambs gaining entrance to the paddock.

‡ The yield of one Cross 7 plot was about 45 per cent. better than the adjoining Solid-straw Tuscan plot, suggesting error. Apart from this plot, however, there was a consistent superiority of Cross 7, and omitting it the difference was still about 4 bushels.

It is not clear whether any importance should be attached to the greater incidence of loose smut in Cross 7, as the seed of Cross 7 used in these trials has never been treated for loose smut, while the Tuscan seed used was only once removed from treatment with hot water.

5. *Resistance to Shaking.*—In spite of the fact that Cross 7 was invariably ripe for some days before being cut loss of grain through shaking was recorded in only three experiments (8, 12, and 13). In these cases loss of grain occurred in both varieties.

6. *Straw-break.*—Heavy winds just before harvest caused a certain amount of straw-break in some of the trials. In three trials (15, 16, and 20) the straw-break was more severe on the Solid-straw Tuscan plots.

COMMENTS ON TABLE 1.

A trial carried out by the Wheat Research Institute at Lincoln College is included in the table for purposes of record. Out of the twenty-six experiments six gave results significantly in favour of Solid-straw Tuscan, and six in favour of Cross 7. In one or two of the remaining trials considerable variation in yields between individual plots of the same variety caused quite appreciable differences in favour of Solid-straw Tuscan to be non-significant. Excluding the result of Experiment 1, which was quite abnormal, due to the lodging of the Tuscan, the average difference in favour of the latter in the twenty-five remaining trials was 0·7 bushels per acre.

MISCELLANEOUS VARIETY TRIALS.

Other varieties were compared with Solid-straw Tuscan in four experiments, two of which were in conjunction with the Cross 7 trials. The yields of these are shown in Table 2.

Table 2.—Yield in Bushels per Acre and Differences of Miscellaneous Varieties from Solid-straw Tuscan.

NOTE.—Differences in heavy type are statistically significant.

Number and Location of Trial and Varieties.	Date Sown	Date Harvested.	Bushels per Acre. Yield of Variety.	Bushels per Acre. Difference in favour of Solid-straw Tuscan (+) or Variety (−).
22. J C Hay, Morven—				
Solid-straw Tuscan ..	10/6/33	15/2/34	58·3* / 56·3†	
Dreadnought 5/27 .	10/6/33	15/2/34	70·6	**−12·8**
College Hunter's II ..	10/6/33	15/2/34	70·1	**13·8**
25. R. B Paton, Pukeuri—				
Solid-straw Tuscan .	18/5/33	10/2/34	28·0	**+2·9**
College Hunter's II ..	18/5/33	10/2/34	25·1	
26. C. G Amyes, Fernside—				
Solid-straw Tuscan ..	28/8/33	25/1/34	26·3	
Jumbuck	28/8/33	18/1/34	26·4	−0·1
27. G. McGregor, Milburn—				
Solid-straw Tuscan ..	8/9/33	6/3/34	47·8	
Jumbuck .. .	8/9/33	20/2/34	38·7	+9·1‡
Marquis	8/9/33	21/2/34	44·4	+3·4‡
Solid-straw Velvet ..	8/9/33	6/3/34	48·2	−0·4‡

* Plots adjacent to Dreadnought 5/27. † Plots adjacent to College Hunter's II. ‡ Yields not examined statistically

COMMENTS ON TABLE 2.

Experiment 22.—Solid-straw Tuscan was badly affected with mildew and both Dreadnought 5/27 and College Hunter's II stood up to the extremely wet conditions prevailing better than did Solid-straw Tuscan.

Experiment 25.—Hunter's II was affected with Hessian Fly and there was more straw-break in this variety than in the case of Solid-straw Tuscan.

Experiment 26.—Owing to a misunderstanding at sowing, Jumbuck was treated with Ceresan New while Tuscan was treated with copper carbonate. These facts must be taken into consideration when comparing the yields as Ceresan New is reputed to have a beneficial effect on yield. Jumbuck suffered severe shaking in four replications. Omitting these the average yield in favour of Jumbuck (not significant) was 2·9 bushels per acre.

Experiment 27.—When cut Jumbuck was over-ripe and it was estimated that about 20 per cent. of the seed was lost as a result of bird attack. Marquis was cut in good condition but Solid-straw Velvet and Tuscan were not so ripe as the other two varieties when cut.

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A. W. Hudson, Crop Experimentalist.

J. W. Woodcock, Assistant Crop Experimentalist.

THE NORTH TARANAKI PASTURE COMPETITION.

REVIEW FOR SEASON 1933–34.

J. M. SMITH, Instructor in Agriculture, New Plymouth.

THE judging of the pasture competition organized by the joint committee representing the Taranaki Agricultural Society and the Farmers' Union has now been completed, and once again this phase of the competitions has been very successful.

Its popularity among the various districts in North and Central Taranaki can be gauged by the increased entries and the increased interest displayed. The following figures indicate the growth of the pasture classes since their inauguration in 1930 :—

TABLE OF ENTRIES.

District.	Season.			
	1933–34.	1932–33.	1931–32.	1930–31.
Urenui	24	22	17	10
Inglewood	6	2	12	17
Huirangi	8	7	12	11
Kaimata	4	3	11	6
Lepperton	8	9	7	4
Tikorangi	7	7	10	2
Okato	9	5	20	..
Toko	10	8	5	..
Tarurutangi	7	8	8	..
Wharehuia	15	16	..	..
Omata	3	4	..	..
Hurworth	..	2	..	..
Oakura	11	..	..	..
Hillsborough ..	3	..	..	..
Totals	115	93	102	50

The adoption of two judgings (spring and autumn) as introduced during the preceding season was adhered to, it being recognized that a pasture to be a good one should produce all the year round. The ideal pasture would be one where there was a thick sward of good grasses giving the same growth each month of the year. That this can never be achieved is obvious, but we can attempt to achieve it, and in so doing give our pastures a longer season of growth, which will be greatly to our advantage. If judging could be carried out each month a fairer allocation of points could be made as regards seasonal growth, but this also is impracticable, and we find that the two judgings give quite a good indication of the season's growth. As was the case last year the autumn was very favourable to pasture growth, and consequently there is very little difference in many cases between the points awarded in the spring and those given in the autumn. However, the mere fact that it was a good autumn intensified the problems of grass management as far as utilization is concerned, and it was possible to indicate to farmers generally the advantages of controlled grazing during a season of abnormal growth. As an indication of what this management might involve, one might point out the fact that the leading pasture was topped with the mower twice during the summer, while another extremely good sward was mown three times during the summer months.

In viewing the pasture competitions this season some farmers have voiced the opinion that increased production following better pasture work will be a bad thing in view of existing markets, &c., but this is a very short-sighted view to take. The cry of reducing our production costs is heard throughout the land to-day, and there is no cheaper method of producing butterfat than by grassland farming, so that

increased butterfat as a result of better grassland farming must result in a reduction of the production costs. There is at least one farmer in North Taranaki to-day (and there are doubtless others) who through good grassland farming is producing butterfat at less than 6d. per pound, an indication that with good grassland farming a profit can be shown even at present prices.

The judging was again carried out by observation and points allotted to various features of the pastures as under. good grasses, 30; clovers, 25; freedom from inferior grasses, 5; freedom from weeds, 10; denseness of sward, 15; evenness of sward, 15: total, 100. While this scale of points is not altogether free from anomalies, it appears to serve the purpose quite well. With regard to the various features indicated, some further explanation is probably necessary. Under the heading "Good Grasses" the percentage in the sward of such grasses as perennial rye, cocksfoot, timothy, dogstail, *Poa trivialis*, prairie, meadow foxtail, and paspalum is noted and also the condition of these species. For instance it is of little value having numerous rye or cocksfoot plants present in the sward if they are not of a leafy strain or not in a healthy vigorous condition giving much feed, and likewise a pasture containing 100 per cent. of good grasses may be one low in production if these grasses are all in a rank unpalatable state. So under this heading we look for a sward composed chiefly of the good grasses indicated in a strong healthy condition, well controlled, and growing much palatable, nutritious feed. The same remarks apply to the points awarded for clovers: here a variety of clovers such as white, red, subterranean, and alsike, in a healthy growing condition and of a good leafy type, is desirable. Many of the Taranaki pastures contain much inferior grass such as sweet vernal, *Poa pratensis*, hair grass, rank fog, and *Danthonia*, with suckling clover and inferior *Lotus*, so that the points allotted for "Freedom from inferior grasses" indicate the presence or absence of these species. It is claimed by some that five points is not sufficient for this feature of a pasture, but it must be remembered that if a pasture is full of these inferior species it cannot contain a large amount of good grasses, so that the points for "Good grasses" must suffer considerably. The points allotted for freedom from weeds need little explaining, except that they indicate a great weakness in our pastures. Plantain, catsear, and other flat weeds occupy too great a proportion of our pasture land, and are the means of greatly reducing our average butterfat production per acre. If a pasture becomes bad with flat weeds the struggle against them is a long arduous one, so that it behoves us to endeavour to establish the pastures without them and keep them out. This can be done by the better preparation of the seed-bed, the sowing of better strains of grasses and clovers, and the increasing of the fertility by putting manure in with the seed, and by subsequent early top-dressing. The "denseness" of the sward is an extremely important feature of the pasture. A pasture viewed from over the fence often looks very fine, but when it is crossed it is found to be very open in the bottom and perhaps only half of the ground actually covered. This means that without any increase of interest rates, living-expenses, and maintenance the production of that paddock could be doubled if the ground could be covered. This could probably be achieved by sowing a better strain mixture of grasses in the first place, or by better grazing and top-dressing subsequently. The last points are given for evenness

and utilization. A good pasture must be one where grazing is well controlled. It is an accepted theory that the production from 100 lb. of controlled Yorkshire fog would exceed that of 100 lb. of rank rye or cocksfoot, so that when one looks on the condition of a pasture with this knowledge in mind one immediately sees the advantages and necessity of controlled grazing (or its equivalent in topping) in the interests of economic production. This feature is particularly prominent in the autumn judging, and particularly where paspalum, in a substantial quantity, is present in the pasture. Paspalum is a good autumn grass, and a paspalum pasture, provided it is comparatively well supplied with rye and clovers, must score well, providing it is kept under control.

An interesting fact is the improvement that has been noted in the pastures judged over the last four seasons. This has in many instances been the direct outcome of the competitions.

It is generally assumed that it is only the best pastures that are entered in these competitions, but this is not always so, as quite a number of farmers enter a paddock of average (or perhaps lower than average) production with a view to determining whether it is improving or deteriorating under his particular system of management. All competitors are asked to give certain particulars in connection with their pastures, and the following information is gleaned from these particulars :—

Acreage of Paddocks. The average acreage of all paddocks entered was 6·9 acres, the actual sizes being : 14 fields of 3 acres ; 14 of 4 acres ; 23 of 5 acres ; 16 of 6 acres ; 8 of 7 acres ; 8 of 8 acres ; 1 of 9 acres ; 14 of 10 to 15 acres ; 3 of 15 to 20 acres ; 1 of over 20 acres.

This indicates that as far as this district is concerned subdivision is fairly good, and this is a big factor in controlled grazing. Naturally the size of the paddocks will depend upon several factors, the principal one of which will be the size of the herd. As an indication of how the smaller paddock, or to put it in another way, the one of heavier carrying-capacity with its better grazing, results in a better pasture, might be quoted the size of the various paddocks in relation to the size of the herds. In this connection the competitors are grouped in tens, and the number of cows per acre quoted, indicating the size of the paddocks in their relation to the size of the herd: Ten best pastures carried 13·1 cows per acre ; second ten, 9·41 ; third ten, 9·76 ; fourth ten, 11·92 ; fifth ten, 10·21 ; sixth ten, 9·33 ; seventh ten, 11·05 ; eighth ten, 9·63 ; ninth ten, 7·84 ; last ten carried 7·7 cows per acre.

Age of Pastures.—The average age of the pastures entered was twelve years, the individual entries being : 3 to 7 years old, 21 entries ; 7 to 10 years old, 13 entries ; 10 to 15 years old, 35 entries ; 15 to 20 years old, 16 entries ; over 20 years old, 17 entries.

One of the conditions in connection with the pasture competition is that the pasture must be at least three years old. Of the pastures over twenty years old some were probably thirty or forty years old, being sown prior to occupancy by the present farmer. The average age of the first ten entries was 11·8 years, showing that some of the oldest pastures in Taranaki are amongst the finest.

Time of Sowing.—Details were available in seventy instances, and of these fifty-four were sown in the autumn and sixteen in the spring. Of the sixteen sown in the spring thirteen were in inland districts (Toko

and Wharehuia), and this indicates the practice common in Taranaki of sowing down in permanent pasture on the coast in the autumn and inland in the spring.

Quantity of Seed per Acre.—This amount varied from 15 lb. to 65 lb. per acre, with the largest number of sowing between 40 lb. and 44 lb. Details are: 15 lb. per acre, 1 entry; 20 lb. to 30 lb., 2 entries; 30 lb. to 40 lb., 4 entries; 40 lb. to 44 lb., 26 entries; 45 lb. to 49 lb., 19 entries; 50 lb. to 54 lb., 4 entries; 55 lb. to 59 lb., 2 entries; 60 lb. to 65 lb., 9 entries.

It is significant that the first three pastures were sown at the rate of 60 lb. per acre. However, to-day, with our improved grass strains and better seed generally, there is not the necessity to sow so heavily; but one must remember that weed control depends largely upon the obtaining of a quick grass cover, and the heavy sowing certainly brings this about expeditiously. However, with a good seed-bed and with the seed well sown, 40 lb. to 45 lb. per acre should suffice. Actually, if every seed germinated and survived 15 lb. per acre would be ample.

Manure with the Seed.—It is common practice in some districts not to sow manure with the seed, but this is not recommended, except where sowing-down is following the grazing-off of such a crop as rape. Unless there is abundant fertility in the surface soil the seedling plants will be slow to establish, and flat weeds will gain a footing. Superphosphate alone was most generally used, although the addition of green bone or bonedust, and perhaps a little lime to the mixture, would be an advantage. Details are: No manure, 5 entries; superphosphate, 26; green bone, 9; bone and super, 8; bonedust, 1; basic super, 2; slag and super, 2, proprietary, 4; rock phosphate, 2.

Subsequent Top-dressing.—The manures used on the grassland varied somewhat with the different types of soil met with. It should be remembered that these pastures are situated in various places from heavy river flats to light loamy uplands, so that any one system of manuring successfully used could hardly be universally adopted. Details of top-dressing for the past three seasons were recorded, and are as follows:—

Kind of Top-dressing	Season		
	1931	1932.	1933
Basic slag	49	25	18
Superphosphate	26	18	20
Lime and super	4	15	19
Super and slag	5	6	3
Basic super	3	3	1
Ammoniated super ..	2	2	1
Phosphate and potash ..	3	6	6
No manure	7	10	15
Proprietary	2	10	13
Rock phosphates	..	2	1
Super and bone	..	4	4
African phosphate ..	3	1	..
Farmyard manure ..	..	..	2

The swing from slag to other manures is undoubtedly the result of financial conditions, which make the unit of phosphate in slag 5–5 as against 3–8 in the case of super, and it is rather remarkable that eighteen used slag in 1933. This proves to what extent those farmers have faith in slag as a grass-producer. The increase in the use of lime and super is also an indication of the times, this being apparently considered an economical manure. The number of farmers who used no manure at all is rather alarming, while the increase in the users of potash is significant. There is little doubt that were prices for produce better, half the farmers in North Taranaki would be using potash, and profitably, too.

Quantity of Top-dressing applied.—The quantities applied varied from about 2 to 7 cwt. per acre, as follows :—

Quantity per Acre.	Season		
	1931	1932	1933
2 cwt. ..	4	4	9
3 ,, ..	74	63	53
4 ,, ..	14	18	17
5 ,, ..	2	2	2
6 ,, ..	1	3	3
7 ,, .	0	1	2

In practically all cases where over 3 cwt was applied two applications were made, one in the autumn and the other in the spring or summer.

Types of Harrows used.– There are a large number of makes of grass-harrows in use in Taranaki, and a number of them do very good work. Some are inclined to be a little too severe unless worked under very exacting conditions, but, on the other hand, many are not effective, due sometimes to the make but most generally to neglect in cleaning frequently. Whilst our knowledge in connection with harrowing for grassland cultivation is not very extensive, we do know that all harrowing that spreads the animal droppings is beneficial. To get a satisfactory spread, the harrows require to be fairly severe to pick up the dried dropping which is often overgrown. With the falling-away in top-dressing much good work can be done to counteract the result by paying more attention to proper harrowing. The following harrows were found to be in use: Tripods (make not stated), 34; chains, 7; Perfect, 11; Reid and Gray, 3; Taylor, 9; Wilson, 3; Whakatane, 8; Duncan, 2; tines on tops of chains, 10; Boothmac, 9; Evona, 3. The number of times the various pastures were harrowed is as follows: 1 stroke, 25 entries; 2 strokes, 27; 3 strokes, 26; 4 strokes, 7; 5 strokes, 3; 6 strokes, 1; 7 strokes, 3; over 7, 2; no harrowing, 9 entries.

Carrying-capacity.—Some additional statistics for this season were in connection with the acreage on the whole farm and the size of

the herd, and the details of these are quite interesting. For instance, they show that on the smaller farms the carrying-capacity is highest, indicating that on these smaller farms more care and attention can be given to proper pasture-management with very beneficial results. It might be argued that these small farms are all on good land, and that this accounts for the higher carrying-capacity; but actually nearly every district represented in the competitions has one or two small farms, so that the effect of any district differences can be discounted. The following table indicates the number of acres per cow on the farms of various sizes: Up to 50 acres, 1·75 acres per cow; 51 to 75 acres, 1·94; 76 to 100 acres, 1·95; 101 to 150 acres, 2·15; over 151 acres, 2·16.

In connection with these carrying-capacity figures, it should be stated that those farms embracing sheep-farming as well as dairying have not been considered, the figures relating to straight-out dairy farms only.

The Relationship of the Rest of the Farm to the Competition Paddock.—It is sometimes stated that competitors in the pasture competition concentrate unduly on the competition paddock, and that therefore it is no indication of the farm or the farmer's ability. This may possibly be so in some isolated instances; but as an indication that in a general way the better carrying-capacity farms usually appear well up in the list may be cited the following table, where the competitors have been grouped according to the points they received and the average carrying-capacity of each group stated: Competitors gaining over 180 points, 1·92 acres per cow; 175 to 179½, 1·99; 170 to 174½, 2·06; 165 to 169½, 2·03, below 164½ 2·33.

The champion pasture for the 1933-34 season was that of Mr. F. Smith, Tarurutangi, which gained 186¾ points. This pasture was very strong in rye-grass, timothy, dogstail, and white clover, although a little weak in cocksfoot. However, as the summer growth of rye-grass was so outstanding, the lack of cocksfoot was not a serious matter. The freedom from weeds and the denseness and evenness of the sward were outstanding features of this pasture. The paddock was 5 acres in extent and fourteen years old. It was sown in the autumn with 60 lb. per acre of seed and top-dressed as follows: 1931, 3 cwt. slag; 1932, 3 cwt, slag and super; 1933, 3 cwt. slag and super; 1934 (January), 1¼ cwt. super, 1¼ cwt. slag, and 58 lb. sulphate of potash. During the past season the pasture has been harrowed nine times and rolled once, and was topped with the mower in November and again in January.

Mr. F. Goodin, Okato, filled second place, this same pasture being second to Mr. D. L. Tate last season. Considering that this was a fairly big paddock, and that nothing was done to it in the way of preparing it for the competition, the paddock is really outstanding. There is a splendid sward of rye-grass and good grasses, and the sward is dense and even. This paddock has been slagged for the past eight years with 3 cwt. of slag annually. It was harrowed four times, and although only 7½ acres in extent grazes 120 cows when being fed off.

Mr. G. F. Mehrtens, of Inglewood, filled third place with the pasture that has always been well up the list. This is an outstanding rye-grass paddock, although a little weak in other species. The paddock is 7 acres in extent, and the pasture thirteen years old. The top-dressing for the past three years has been 450 lb. lime and super; 4 cwt. slag; and 350 lb. of blood and bone/super.

Mr. J. N. Blyde, Lepperton, filled fourth place with a fifteen-year-old pasture, 3½ acres in extent. The last three years' top-dressing has been: 1931, 1 cwt. 30 per cent. potash, 2 cwt. super (summer), 3½ cwt. slag (winter); 1932, 1½ cwt. 30 per cent. potash, 2 cwt. super (summer), and 3 cwt. lime and super (winter); 1933, 2 cwt. super (spring), 2 cwt. potash, 3 cwt. super (summer), and 3 cwt. of lime in June; 1934, 1½ cwt. 30 per cent. potash and 2½ cwt. super (summer). This paddock was also topped three times this season and was harrowed three times.

"SORE-SHIN": A VIRUS DISEASE OF BLUE LUPINS.

J. C. NEILL, R. M. BRIEN, and E. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North

DURING the past three years a disease, for which the name "sore-shin" is suggested, has been prevalent in blue-lupin crops in various parts of New Zealand. This disease, which ultimately causes death of infected plants, has been observed in Hawke's Bay, Taupo, Taranaki, Manawatu, Wairarapa, Nelson, Canterbury, and Otago. The incidence is usually greatest where successive crops are grown for green manure. At the Plant Research Station Area, where "sore-shin" has been troublesome each season, 100 per cent. of the plants in one plot became infected, while in other localities infections up to 50 per cent. have been reported.

SYMPTOMS.

The first visible symptoms of the disease are a slight stunting of the plant, associated with the characteristic curling of the growing point to one side (Fig. 1). Simultaneously, a light-brown streak appears on that side, extending the whole length of the stem. Growth ceases with the appearance of the first symptoms of the disease. On cutting, the vascular system of infected plants shows a brown discoloration, which is more extensive in the roots and growing-points than on the main stem. The discoloured area subsequently extends until the whole stem become brown.* The young leaves at first wilt (Fig. 2) and then turn black, while the older ones become tinged with purple, turn yellow, and ultimately fall (Fig. 3). The stem turns black, the roots decay, and finally the plant dies. Infection takes place at all stages of growth, being observed in seedlings 4 in. tall and mature seeding plants.

* Dark-brown lesions often appear on the stems of infected plants about ground-level. These are caused by saprophytes, which have gained entrance after the initial virus infection.

FIG. 1. EARLY SYMPTOMS OF "SORE-SHIN" ON INOCULATED LUPIN PLANTS GROWN IN THE GLASSHOUSE. HEALTHY PLANTS ON LEFT.

[*Photo by H. Drake.*

Determination of the Causal Organism.

Since no references to this disease could be found in the available literature, experiments were undertaken to determine its cause. These consisted of (1) isolations from infected material; (2) inoculation of isolants into healthy lupin plants; (3) experiments on soil reactions; and (4) tests for the presence of virus.

Many isolations were made from the vascular system of stems and roots, and also from stem lesions. Bacteria were frequently, but not always, isolated from the discoloured vascular tissues, while both bacteria and a *Fusarium* sp. (*Elegans* section) were associated in lesions on the stems.

Inoculation Experiments.

In each of the following experiments seed, which was collected from "sore-shin" free plants, was sown in sterilized soil in an insect-proof glasshouse or cage. The plants were allowed to remain in the house for about two months after planting. At this stage they were approximately 5 ft. tall.

INOCULATIONS WITH BACTERIA

(*a*) *Wound-inoculations.*—Forty plants when 6 in. tall were wound-inoculated just above ground-level with bacteria from plate cultures. One plant developed the disease, while all the rest remained healthy.*

(*b*) *Inoculation of Germinated Seed.*—Eighty seeds were germinated on the surface of the soil under a sterilized cloth cover. Before the young plants had taken root they were lifted, rubbed on agar-plate cultures of bacteria, and then planted. None of these plants developed "sore-shin."

(*c*) *Seed-inoculation.*—Eighty lupin-seeds were dipped in a suspension of bacteria and then sown. No sign of the disease appeared in any of these plants.

As a control to the above inoculations eighty untreated lupin plants were grown under similar conditions. These all remained healthy.

INOCULATIONS WITH FUSARIUM SP.

(*a*) *Wound-inoculations.*—Forty plants when 6 in. tall were wound-inoculated as above with *Fusarium* isolated from "sore-shin" infected plants. None of the plants developed the disease.

(*b*) *Soil-inoculations in the Glasshouse.*—Forty 4 in. pots of sterilized soil were sown with three seeds per pot. Before covering, a suspension of mashed cultures of the *Fusarium* was poured over the seeds contained in twenty of the pots. The remainder were left uninoculated. All plants remained healthy throughout the growing period.

* In preparing the bacterial cultures for these inoculations, small portions of discoloured tissue from infected plants were placed on culture media in petri dishes In making inoculations the bacteria, in some cases with a piece of the original stem tissue, were removed with a needle and inserted in a wound at the base of the stem. In the light of later experiments, it would appear that infection of this particular plant was caused by the accidental transference of a virus-infected portion of tissue from the petri dish.

FIG. 2. LUPIN PLANT SHOWING WILTING OF YOUNG LEAVES AND CURLING OF GROWING POINTS CAUSED BY THE "SORE-SHIN" VIRUS.

[Photo by H. Drake.

(*c*) *Soil-inoculations in Insect-proof Cage.*—On the 22nd March, 1932, sixteen boxes of sterilized soil were inoculated with agar-plate cultures of the *Fusarium* isolated from infected plants. Two boxes were left uninoculated. Three boxes were dressed with burnt lime at the rate of 1, 3, and 8 tons per acre respectively on the following dates: 8th April, 1932, 9th May, 1932, 21st July, 1932, and 22nd September, 1932. Four boxes remained unlimed. On the 22nd September, 1932, each box was sown with ten lupin-seeds. No "sore-shin" developed in any of the plants.

INOCULATIONS WITH DISEASED TISSUE OF INFECTED PLANTS.

(*a*) *Soil-inoculation in the Glasshouse.*—Infected lupin plants were cut 6 in. above ground-level and the stems crushed and buried in boxes of sterilized soil. Sixty seeds were sown in this inoculated soil. No infection occurred on any of the plants.

(*b*) *Soil-inoculation in Insect-proof Cage.*—On the 22nd March, 1932, sixteen boxes of sterilized soil were inoculated with mashed diseased blue-lupin roots, while two boxes were left uninoculated. The same dressings of burnt lime were applied as described above, four boxes were left unlimed, and each box was sown with ten blue-lupin seeds on the 22nd September, 1932. No "sore-shin" developed in any of the plants.

SEED TRANSMISSION OF THE DISEASE.

Seed was collected from infected plants in the field, and on the same day 160 were sown in sterilized soil in the glasshouse. Although the germination was low (72 per cent.), the plants which developed remained healthy throughout the growing period.

FIELD EXPERIMENTS WITH LIME AND FERTILIZERS.

Two one-tenth acre plots which had been in potatoes the previous season were used for this experiment One was dressed with ground limestone at the rate of 2 tons per acre, and the other at 1 ton per acre Each plot was divided into sixteen sections, and on each of the following dates, 8th April, 1932, 5th May, 1932, 12th July, 1932, and 20th September, 1932, three were dressed with burnt lime at the rate of 1, 3, and 5 tons per acre respectively. The remaining four sections in each plot were not treated. All were sown on the 21st September, 1932, with blue-lupin seed in drills 2 ft. apart, the seed being spaced 1 ft. apart in the drills. In each section the following fertilizers were sown with the seed in duplicate drills: Basic slag, 3 cwt. per acre; superphosphate, 3 cwt. per acre; and super-burnt-lime mixture (50–50), 6 cwt. per acre. Four drills in each section were sown without fertilizers.

On the first inspection, made when the plants were 9 in. tall, infected plants were found throughout the plots, their location bearing no constant relation to the amount or date of liming, or to the fertilizers. At this time all the infected plants were removed. On the second inspection, the plants then being 18 in. tall and showing flowering heads, a further series of diseased plants were removed. These occurred in every section and with all

manures. No plants were removed on subsequent inspections. By mid-January, when the seed was ripening, practically every plant showed symptoms of the disease.

The adjoining land to these plots had been used for experiments on Sclerotinia-disease of blue lupins for the previous two seasons,

FIG. 3 ADVANCED STAGE OF "SORE-SHIN" INFECTION ON LUPIN PLANT TAKEN FROM THE FIELD HEALTHY PLANT ON RIGHT. [*Photo by H. Drake.*

and "sore-shin" had occurred sporadically. On this land an autumn-sown strip of lupins, in which numerous cases of "sore-shin" were present, adjoined the plots used in the above experiment, being separated from them by a pathway 4 ft. wide.

Determination of the Virus Nature of the Disease.

From the foregoing experiments it appeared that none of the organisms isolated was the primary cause of the disease. The symptoms and manner of spread suggested that the condition might be due to a virus. The virus nature of any disease may be proved by reproducing the symptoms on a healthy plant either (1) by transference of insects which have fed on the diseased plant, or (2) by artificial inoculation with juice extracted from diseased material. The following experiments were carried out to determine whether "sore-shin" was brought about by a virus.

EXPERIMENTAL METHOD.

Lupins were grown in pots of sterilized soil in an insect-free glasshouse. The source of inoculum was in each case "sore-shin" infected plants from the field. These plants were ground in a mortar and the juice strained through muslin. Inoculations were made by rubbing the leaves of healthy plants with muslin moistened with the undiluted juice. The roughness of the material caused tiny scratches and bruises on the leaves, thereby allowing the juice to come in contact with the living tissue. In the earlier experiments, inoculations were carried out on lupins about 9 in. tall, but later it was found more satisfactory to inoculate plants when about 12 in tall.

RESULTS OF INOCULATIONS.

For the first experiment eighteen plants were inoculated and the same number left as controls. Two inoculated plants developed typical symptoms of the disease, while all the controls remained healthy

A further experiment was carried out using twenty-six plants for inoculation and fifteen for controls. Of the twenty-six inoculated plants, seven developed the disease while the control plants remained healthy. In a third experiment forty-five plants were inoculated and fifteen left as controls. The plants were observed daily, and the first symptoms appeared on some plants on the tenth day after inoculation. An inspection made three weeks after inoculation showed that twenty-four of the inoculated plants had developed typical symptoms of the disease. All uninoculated plants remained healthy.

In the three experiments a total of eighty-nine plants were inoculated, and of these thirty-three (or 37 per cent.) developed the disease. No "sore-shin" developed in the forty-eight plants used as controls.

These experiments indicate that "sore-shin" is a virus disease, which is apparently not seed-borne. Experiments on insect transmission are now being undertaken, and results will be published in another article.

Summary.

(1) A disease, herein termed "sore-shin," is recorded as being prevalent on blue lupins in New Zealand.

(2) The symptoms of the disease are discoloration of the vascular tissues, wilting of the young leaves, decay of the roots, and ultimately death of the plant.

(3) Isolations from diseased material yielded bacteria and a *Fusarium* sp., which when inoculated into healthy plants failed to reproduce the disease.

(4) Virus inoculations, consisting of leaf-rubbing with juice from infected plants, reproduced typical symptoms on thirty-three out of eighty-nine plants.

(5) No disease appeared in 115 plants grown from seed collected from infected lupins

SOME MISCONCEPTIONS ABOUT LUCERNE.*

R P CONNELL, Fields Division, Palmerston North

PROBABLY no other crop available to New Zealand farming has associated with it so many valuable potentialities and so many vital misconceptions as has lucerne. Of course, grassland exceeds it in national importance and possibly also in unexploited potentialities, but the basic misconceptions that attach to lucerne fortunately do not attach to grassland. As these misconceptions are the primary cause of the unexploited potentialities of lucerne, some consideration of them seems worth while.

One of these misconceptions relates to the status of lucerne. It is believed by many that lucerne is still under trial and that it would be as well to let others take any risk involved in the trials that are needed. Actually lucerne is well past the experimental stage in New Zealand. Experience with lucerne has extended over many years and over many conditions. The experience has been ample to indicate that a much greater area could profitably be sown in lucerne in New Zealand. And it has been varied enough to provide information about where lucerne may and may not be sown with reasonable prospects of attractive returns. Hence, provided work with lucerne is based upon the best available knowledge, no unknown risk need be taken.

The area in lucerne in New Zealand is relatively small. For instance, it is substantially less than the area in lucerne in England and Wales, which, in turn, are of much less area than New Zealand. England, incidentally, has had experience with lucerne since the seventeenth century, so that lucerne can hardly be looked upon as a "new" crop. Further facts which enable comparisons to be made relative to lucerne exploitation are: (1) The live-stock industry of Canada is slightly greater than that of New Zealand; its lucerne area is thirteen times as great. (2) The live-stock industry of Argentina is about five times as great as that of New Zealand; its lucerne area is 632 times as great. While it does not follow necessarily that New Zealand should make lucerne as prominent in its farming as the countries just mentioned, it would certainly seem that New Zealand should give more consideration to the potentialities of lucerne.

* Substance of a lecturette broadcast from Station 2YA.

It is gratifying that official returns show that lucerne is steadily increasing in popularity in New Zealand. Since the first time lucerne was recorded as a separate crop, seven seasons ago, the area in lucerne has increased 30 per cent. The figures for the year ending the 31st March last are not available, but during that year the sales of cultures by the Department were sufficient to treat the quantity of seed required for the sowing of over 6,000 acres, so that a further substantial expansion in the Dominion acreage of lucerne may be expected.

A vital misconception about lucerne is that it is costly to establish. Actually under ordinary circumstances the cost of establishing an acre of lucerne and that of sowing down the same land in permanent pasture are practically equal. In the first place, as to the cost of material, the current prices in the Wellington Province are—

For 1 Acre of Lucerne : 15 lb. of seed, £1 8s 9d. , 1 ton of lime, 13s. 6d ; culture, 1s. : total, £2 3s. 3d.

For 1 Acre of Permanent Pasture : 25 lb. perennial rye-grass, £1 13s. 9d. , 10 lb. cocksfoot, 15s. ; 3 lb. timothy, 2s. 3d. , 3 lb. dogstail, 3s. 9d. , 3 lb red clover, 3s 9d ; 2 lb. white clover, 4s. 2d. : total, £2 2s. 8d.

In the second place, the preparatory cultivation and manuring needed for the one in general would serve equally well for the other Suitably located, lucerne as a rule lasts as a profitable crop for many years—in fact, it becomes practically as permanent as many pastures that are designed to be permanent. But should the life of the lucerne be limited to five or six years, as it occasionally is, then the initial cost of establishment spread over so many years is but a slight overhead charge relative to the good returns that successful lucerne gives. In view of the data just given, the origin of the belief that lucerne is exceptionally costly to establish remains somewhat obscure.

A misconception that deters many from sowing an area in lucerne is found in the belief that it is specially exacting in its requirements. Curiously, a contradictory misconception is involved in the occasional practice of selecting for lucerne an inhospitable area of ground—at times one which is worn out or which is gravelly and dries out badly in the summer, and which will support no other crops satisfactorily.

Relative to the requirements of lucerne in respect to soil, the position in New Zealand is briefly that lucerne has been grown successfully on practically all types of well-drained soils except peaty ones.

Undoubtedly on deep, fertile, open, well-drained soils lucerne gives the best results, and lucerne is of such intrinsic merit when successful that it should be allotted soil of this nature when at all possible. Good surface drainage and underdrainage are both necessary. If the land available is not highly fertile, it should be made so by suitable treatment. Lucerne culture in Central Otago rather well illustrates the correlation between soil fertility and success with lucerne. Ten samples taken as typical of the different Central Otago soils contained on the average over 2½ per cent. of lime and nearly 2 per cent. of potash. These figures represent an unusually heavy

soil supply of lime and potash, and the analyses revealed further that the soils were naturally rich in phosphates. The marked success which characterizes lucerne in Central Otago may be linked definitely with the richness of the soils in important minerals, as indicated by the figures just mentioned. Some seem to incline to the belief that lucerne is suited only for relatively dry climatic conditions such as would occur, for example, in localities of less than 30 in. of rainfall. This belief that the usefulness of lucerne is restricted to relatively dry conditions arises probably from the fact that the merits of lucerne are apt to be particularly emphasized under dry conditions. For instance, when droughty conditions prevail in Canterbury, Marlborough, or Hawke's Bay, then it is that the special value of an area of lucerne becomes particularly apparent, for under such conditions lucerne is likely to be the only crop making fresh vigorous growth. But New Zealand experience has definitely shown it is unsound to hold that the use of lucerne should be restricted to the drier farming areas. In proof of this it need be mentioned only that for years thousands of acres of lucerne have given markedly profitable returns in Taranaki, one of our wettest provinces, and that numerous highly profitable areas of lucerne are to be found in parts of the Auckland and Wellington Provinces in which the rainfall is well in excess of 30 in. a year.

In this connection the principal distribution of lucerne in New Zealand is interesting. In round figures there are 6,000 acres in the Auckland and Gisborne districts, 4,500 acres in Hawke's Bay, 5,000 acres in Taranaki, 3,000 acres in Wellington, 5,000 acres in Canterbury, and 9,000 acres in Otago. The New Zealand experience as to the adaptability of lucerne conforms with the experience of other countries. As an illustration of this, Circular 35 of the Californian Agricultural Extension Service states :—

"The type of soil is of little importance, provided it is deep and friable enough to permit the ready penetration of water and plant-roots, and is well supplied with the mineral elements necessary for plant growth, especially lime, phosphorus, and sulphur. Good drainage is also necessary. . . . The soil should, in addition, be well supplied with organic matter or humus, although excellent yields have been obtained on soil deficient in this constituent."

A belief that is accorded fairly wide acceptance is that lucerne when satisfactorily established requires so much attention as to be of questionable value compared with other crops that can be employed satisfactorily with much less attention. In one respect successful lucerne does call for much labour annually. In many districts it is likely to involve not only a cutting for ensilage, but also two to four other cuttings for hay or green feed. In brief, in its harvesting it often requires as much labour as a series of many other crops; but to object to it on this account is parallel action to that of a not over-energetic farmer who remarked that one should to some extent be thankful for a drought, because it resulted in much less work at harvest-time.

But it is a distinct misconception to consider that, apart from harvesting, a great deal of attention in the form of cultivation always needs to be given throughout the year to lucerne. It is a misconception which arises from advice without much basis in

practice which is at times voiced. The following statements from the Department's bulletin on lucerne indicate briefly the position: "Principally as a means of reducing the competition of weeds, cultivation of lucerne is at times well worth while. For such cultivation to be of value it is essential, firstly, that the lucerne be not greatly damaged and, secondly, that the cultivation be done under the conditions which will most greatly reduce the competition of weeds. . . . As a rule, a suitable time for such cultivation is after the second or third cuts; the dry weather then experienced assists in the destruction of the weeds. . . . Cultivation under relatively wet or cold conditions is an unsound practice."

From these statements it may be deduced that indiscriminate or drastic cultivation may do more harm than good, and that winter and spring cultivation is often likely to be inadvisable. There is evidence that many failures of lucerne have been brought about, usually in a gradual way, by unnecessary or injudicious cultivation. If the cultivation is severe enough to dislodge weeds, then each time it is carried out it is practically sure to destroy some lucerne plants, and eventually the crop may become so thinned as not to be worth while. In brief, cultivation of lucerne should not be looked upon as a routine practice. It should be based on an intelligent interpretation of the requirements of a crop—certain crops may not need cultivation, other crops may need cultivation which, to be valuable, requires to be done at definite seasons. Usually winter and spring cultivation is inadvisable.

Some mistaken practices lead to but brief profitable lives for stands of lucerne that under good management would be successful for many years. One of these practices is failure to top-dress suitably for the purpose of providing fertility, which at the beginning may not have been high enough to give maximum returns from lucerne, and which is depleted relatively rapidly in the removal of crops of hay, silage, and green feed.

Another of the practices which in most districts tend to shorten the profitable life of lucerne stands is grazing. The consolidation caused by the grazing favours such plants as grasses and clover, which often compete injuriously with lucerne.

A practice which is likely to weaken lucerne if it is in competition with plants which make growth earlier than it in the spring is deferring the first cut of the season longer than is necessary. This, which is likely to occur when the first cut is utilized not for ensilage but for haymaking, prolongs the harmful competition of the invading plants.

A further practice which will quickly weaken lucerne is mowing too frequently during the growing season—*i.e.*, mowing before the crop is sufficiently mature. This and other matters which have been considered and lucerne culture generally are discussed at considerable length in Bulletin No. 155 of this Department, which is available for free distribution.

It is deemed advisable to discuss at this season the matters mentioned above mainly because, if preparatory cultivation for new areas of lucerne has not already been started, it should, as a rule, be commenced at an early date.

LIVE-STOCK POISONING IN NEW ZEALAND.*

B. C. ASTON, Chief Chemist, Department of Agriculture

FREQUENT cases of poisoning in live-stock have made it desirable that the matter should be considered in all its bearings, and to this end the following account has been compiled. It embodies the result of over thirty years' experience in investigating suspicious mortality in live-stock with a view to the detection of poison in the animal or the food upon which it had fed.

It may be accepted that domestic stock, including animals of all kinds, poultry, fishes, and invertebrates, such as bees, may be the subject of inquiry, and these may have eaten or otherwise absorbed poison which caused their deaths, and that these phenomena may be conveniently classified under four headings, chosen for the sake of convenience rather than on any strictly scientific ground: (1) Inorganic or mineral poisons or preparations used for destroying unwanted forms of life, (2) indigenous poisonous plants, (3) wild exotic poisonous plants, and (4) cultivated exotic poisonous plants.

MINERAL POISONS OR PREPARATIONS.

Under the first heading should be included all poisonous metallic compounds such as those of arsenic, lead, antimony, phosphorus, mercury, as well as of organic compounds such as the cyanides and hydrocyanic acid, strychnine, &c., frequently used in agriculture as animal poison, plant fumigant, or weed-killer. Arsenic compounds are largely used as weed-killers. Lead compounds, as paint, are most deadly in the shape of old paint tins containing some of the moist paint, and also recently painted fences, gates, or even houses. Recent paint is especially attractive to cattle on account of the linseed oil with which the paints are mixed. Phosphorus is largely used for rabbit poison, and the cyanides for fumigating greenhouses, while strychnine is more and more used in certain seasons for killing rabbits. Caustic preparations are used in cleaning dairy apparatus; and it appears almost certain that the effluents running in open drains in dry weather may be consumed by stock, and if containing sodium hydrate or carbonate are injurious in proportion to the amount consumed. Excessive doses of salt such as may be found in kitchen refuse may be fatal to pigs and poultry if fed to those animals.

INDIGENOUS POISONOUS PLANTS.

The poisonous native plants of New Zealand, although comparatively few in number, are a most decided menace to stock-owners where there is any rough or virgin or partially broken-in land, or where the animals are driven through such areas. Poisoning by several New Zealand plants is more insidious, as some of them are, in limited amounts, beneficial in so much as they are undoubtedly highly relished and are good grazing material. It is only when the animals are driven or starved or are ravenous for a change of diet that they consume such large quantities that poisoning occurs. An endeavour is made below to place

* Portion of a paper read before the New Zealand Veterinary Association, Wellington, 26th July, 1933

these New Zealand native plants in the relative order of their importance, an arrangement which, in the main, is considered justified: (1) *Coriaria* (3 or 4 species), tutu or tupakihi, (2) *Pteridium aquilinum*, bracken or fern; (3) *Myoporum laetum*, ngaio; (4) *Pimelia* (several species), Strathmore weed; (5) *Brachyglottis rangiora*, rangiora; (6) *Urtica ferox*, onga onga or tree nettle; (7) *Wintera (Drimys) axillaris*, horopito or pepper tree; (8) *Hydrocotyle asiatica*, pennywort; (9) *Edwardsia (Sophora) tetraptera* (several species), kowhai; (10) *Ranunculus rivularis* (swamp buttercup), waoriki, (11) *Dianella intermedia*, turutu, (12) *Euphorbia glauca*, waiuatua; (13) *Parsonsia* (2 species), kaiku, (14) *Corynocarpus laevigata*, karaka.

The first four plants are undoubtedly responsible for stock poisoning from time to time, mainly the result of an abnormally low natural food-supply or a too restricted diet of an artificial kind. There is no doubt as to the poisonous nature of all four in New Zealand, and this is supported by what might be called their family history—that is, the known effects of closely allied plants in other countries. In the case of fern, stock are often crowded on to young grass country where the young fern is coming through in order to stamp and eat it out and no doubt experience poisonous effects in addition to starvation.

The tutu (*Coriaria* sp.) is the most historic poisoning plant of New Zealand, as Captain Cook lost the first animals he introduced by "toot" poisoning, as it is called by the settler. Dr. Lauder Lindsay states that in the early days those colonists were fortunate who had not lost 25 per cent. of their stock through tutu poisoning at the time of his visit (1861). Like another poisonous plant, ragwort, tutu in one of its forms is greatly relished by sheep, at times forming no inconsiderable part of their diet on rough hilly country. Cattle may also eat it in moderation, but when driven or when hungering for a change of diet, such as after being on a turnip paddock, they quickly succumb to large quantities of tutu ingested. This appears to be the case with all kinds of herbivores which will eat it, but it must be noted that no case in horses has ever been reported and presumably it is distasteful to that animal.

There is a considerable literature on *Coriaria* or tutu, and the scientific results of the study of the active principle tutin ($C_{17}H_{20}O_7$), which was first isolated in this Department's chemical laboratory in 1900. There is still a large field for investigation in regard to the anomalous action of tutu plant on stock in the field and why at times it may be consumed as a regular part of the diet and at other times may act as a powerful and immediate poison: possibly there may be a very simple explanation for this. It has been proved thoroughly that the active principle tutin is destroyed very quickly by alkalies. The rumen contents are, of course, alkaline, so that if one could ensure that the whole of the ingested tutu entered the rumen one might predict beneficial instead of poisonous results from this palatable food. Cattle, in crunching up the long juicy shoots of the tutu produced in early summer, must surely squeeze out a large amount of liquid, which goes direct into the acid compartments of their digestive system without passing into the rumen. Therefore the tutin in this juice would have less chance of being destroyed by the alkaline secretion of the rumen. Perhaps this is the reason why cattle are more susceptible than sheep, which ingest into the rumen a drier form of the plant—namely, the leaves—

as they have less opportunity than cattle have for obtaining the giant shoots. Those who desire to follow the history of tutu poisoning in New Zealand cannot do better than consult the bibliography given on p. 143 of the Annual Report of this Department for 1900, and Dr. Fitchett's paper on the Physiological Action of Tutin, Trans. N.Z. Inst., Vol. 41, 1908, p. 365.

The next most common source of poisoning from plants is that occasioned by the New Zealand bracken fern (*Pteridium aquilinum)*, variety *esculenta*, the roots of which were the staple farinaceous food of the primitive Maori. The above-ground parts are undoubtedly poisonous, and one American investigator of the bracken there showed that a drug habit was acquired by horses eating the fern, so that when stall-fed they ate their own bedding of bracken in preference to good hay. Exact feeding experiments have also been carried out in Great Britain and the poisonous nature of the English bracken fully demonstrated (see this Department's *Journal* for April, 1923).

Myoporum laetum (the ngaio), the well-known coastal tree, undoubtedly causes a large number of deaths in cattle every year, especially in the stormy winter season, when large limbs or trees are blown down into the paddocks and enable leaves, fruit, and branchlets to be reached by the cattle, which, possibly owing to shortness of feed at that time, greedily devour sufficient of the plant to cause poisonous symptoms. This is the time of the year when the fruit is ripe. In Australia an allied species (*M. deserti*) has poisoned sheep, according to Maiden, but only when the shrub is in fruit. He gives one instance of 500 out of a mob of 7,000 sheep dying from eating this poisonous plant (" Plants reputed poisonous to Stock in Australia," *Agricultural Gazette*, New South Wales, Vol. 8, 1897, p. 17). It is therefore quite probable that the New Zealand ngaio may be similarly fatal to sheep if they are compelled to eat it, although no instance of it affecting sheep has come under notice. Ewart (" Poison Plants and Naturalized Aliens of Victoria," 1909, p. 50) remarks that *M. deserti* is supposed to be poisonous when in fruit. This Department's *Journal* for August, 1926, contains an account by Webster of the poisoning of steers in Taranaki by eating ngaio. A Waikanae farmer lost five young heifers from ngaio poisoning in July, 1927. The ingesta consisted chiefly of ngaio leaves from an uprooted tree. Recently this species has been suspected of poisoning horses at Waverley. The most outstanding fact of all the cases in cattle is that the season was late autumn or winter, May to August. Some New Zealand veterinarians (this *Journal*, August, 1926) consider that the fruit of the ngaio is the poisonous part. Be this as it may, the oil of the leaves appears to be non-poisonous to guinea-pigs (see this Department's Annual Report, 1900, p. 127).

There are several species of *Pimelia* in New Zealand. Cheeseman in the " Manual of New Zealand Flora " records as many as fifteen species, but there may be several more, as the genus has not been critically studied. It is known in New Zealand generally as Strathmore weed, from the name of a Taranaki town where poisoning of horses was first recorded (see this Department's leaflet to farmers on the plant). The genus is confined to Australia and New Zealand. In Queensland several species are suspected of poisoning sheep. The genus *Pimelia* is closely allied to *Daphne*, a species of which are so much grown in gardens for the ornamental scented flowers produced. Daphne supplied a vesicant

to medicine under the name mezereon bark, and the Pimelias have a similar action in causing blisters and burning sensation in the mouth when chewed. This sensation persists for some time, and is a common symptom resulting from every species the writer has tasted. New Zealand cases of poisoning recorded relate largely to horses. A dry resinous mass which was extracted by volatile solvents from *Pimelia* bark by the writer was poisonous to guinea-pigs (see leaflet to farmers, No. 55, 1900). Some cases are recorded by Webster in the August, 1926, *Journal* of this Department, p. 102, in the Wairarapa. A case of mortality in calves which occurred at Te Kuiti in October, 1928, was probably due to leaving travelling stock (calves) in a starving condition in a paddock in which there was little else but *Pimelia*. This case was reported by the Stock Inspector of that district.

In any case where veterinarians find as a symptom blisters in the mouths of stock they would do well to seek the evidence of the ingestion of one of the species of *Pimelia*, all of which are found on stony or sandy waste land and often by roadsides where driven hungry stock are allowed to pasture.

Seddon and others (Veterinary Research Report, No. 6, Department of Agriculture, New South Wales, 1931, p 122) give details of the poisoning of travelling sheep by eating *Pimelia pauciflora*, an Australian species. Feeding experiments by his Department confirmed the poisonous nature of the plant, but apparently animals would only eat it when starved. The prominent symptom recorded was acute gastro-enteritis. The *Pimelia* is one of the few plants that cause coarse anatomical changes when ingested by animals.

The rangiora (*Brachyglottis rangiora*) belongs to the largest botanical family of flowering plants, the *Compositae*, which contains all those plants producing "daisy" flowers. Although a common plant, the rangiora is but rarely suspected of poisoning stock. Baber (1886) states that this shrub is seldom eaten by cattle or sheep, but that horses are very fond of it. The effect on animals is said to be a staggering of the legs and falling. Skey (1881) failed to recognize any poisonous principle from *Brachyglottis*. The poisonous nature of some wild honey has been attributed to nectar from rangiora. The drunken condition of horses after eating rangiora leaves is stated by farmers to be curable by briskly exercising them. Elsdon Best (personal communication, 1900) reported that horses are supposed to be "wharangied" when poisoned by the rangiora, "wharangi" being another Native name for the shrub. Blood-letting and violent exercise are the Native cures. His own horse had been "wharangied," and had to be taken for a three-mile sharp canter to cure it. The stimulating nature of the rangiora poison is interesting in view of the fact that the imported ragwort belongs to the same family, and is highly poisonous to cattle and horses but less so to sheep, for which it is, in moderation, a useful fodder. In connection with the prominent symptom in horses—staggering—it is of interest to note that one of the English trivial names is "staggerwort." Apparently, from the observation of farmers who have communicated with the writer, cattle and sheep are seldom poisoned by rangiora, although they are known to eat large quantities of the leaves.

Urtica ferox (onga onga or tree nettle).—H. Guthrie Smith in "Tutira," 1921, p. 109, mentions that this unpleasant-looking plant

had caused the deaths of a horse and dogs. "My rabbiter lost one dog and had others crippled for days by this terrible nettle ; a shepherd unwisely attempted to rush his well-bred horse through a mass of it, the animal became unmanageable, rolled, and refused to rise. Next day it was found dead." Mr. E. Liffiton, Wanganui, reported that a sporting dog stuck his nose into a bush, and apparently lost his scent for a week. Another struck himself between the hind legs, and was nearly dead for about a week. A horse blundering over a bush died in convulsions in three hours (Annual Report, New Zealand Department of Agriculture, 1909, p. 180). Recently, in the hills east of Lake Wairarapa, *Urtica ferox* has been suspected of injuriously affecting sporting dogs. According to Long ("Plants poisonous to Live-stock," 1924, Cambridge Press) the European giant nettle (*Urtica dioica*) is stated to have caused the deaths of dogs in Germany.

The horopito (*Drimys (Wintera) colorata*) is recorded as having poisoned cows at Okoroire in May, 1910, a large amount of the leaves being found in the ingesta. The leaves of both the New Zealand species are hot to the taste and are not likely to be eaten by stock unless they are driven by starvation to do so The well-known Winter's bark comes from a South American species. The pennyworts (*Hydrocotyle*) belong to a world-wide genus. There are a number of species in New Zealand, but the only one concerning which there is any suspicion as being poisonous to stock is *H. asiatica*, now known as *Centella*, a cosmopolitan weed. This plant is said by Grandpré (1888, Nouv. Rem., April 8) to be an energetic stimulant, and in large doses a narcotic producing stupor, headache, and in some persons vertigo with a tendency to coma A European species, *H vulgaris*, is stated to have caused inflammation of the digestive tract and hæmaturia and to contain a toxic substance "vellarin." *H. asiatica* is a common weed often existing as a dense sward under manuka scrub in many parts of the North Island, and sheep may be driven by hunger to eat it. On the east coast of the Wellington Province a case of poisoning in sheep which has been supposed to have been caused by this weed has been reported at Akitio by Mr. R H Meade, Government Veterinarian. The symptoms he noticed were vertigo, stupor, and falling down and struggling at times, the animals remaining in this state for about a fortnight before death. On post-mortem the livers were found creamy-looking and atrophied, and the kidneys diseased, but the carcass fat and well nourished. It is interesting to recall that two of the trivial English names of the marsh pennywort (*H. vulgaris*) are "sheep-rot" and "white-rot."

A small native buttercup, *Ranunculus rivularis*, occurring plentifully in the swampy ground is known by the Maori name waoriki, and sheep are often found poisoned when grazing in swamps, and the cause is put down to waoriki. It is, however, difficult to identify any particular species from the swamp as having caused the mortality. Other swamp plants which have come under suspicion are the native *Pratia* and the allied *Lobelia*. Sheep fed on *Pratia* fruit at the Rangipo Prison camp failed, however, to show any poisonous symptoms. Another swamp plant, *Gratiola*, may be held under suspicion on the authority of Maiden, who also quotes cases of horses being poisoned by *Pratia erecta*, and cows by *Lobelia pratioides*, and sheep by *Isotoma* in Australia. A student, therefore, who wishes to investigate mortality arising from

swamp feeding of domestic stock has a range of possible species to investigate. Instances of the poisoning of cattle by waoriki are given in the 1905 Annual Report of this Department, p. 79.

In addition to the plants named in the above paragraph, there are a number of New Zealand species which must be held suspicious on account of their family history and known toxic effects of closely allied species in other countries. The fact that little is known of them as poisonous plants may be due to their unpalatable nature and to abundance of other food. The kowhais (*Sophora* or *Edwardsia*), of which there are several species, are probably all poisonous, but stock are not known to eat them.

Dianella (turutu), a small grass-like herb, is known to poison children who have eaten its attractive-looking blue fruits *Euphorbia glauca* (waiuatua) is not likely to be eaten owing to its extremely unpalatable nature. It belongs to a very poisonous family. *Parsonsia* (kaiku) is a twining shrub belonging to a very poisonous family, *Apocynaceae*, but no evidence is available that it is ever eaten.

The karaka (*Corynocarpus laevigata*) is a well-known tree throughout the northern part of New Zealand, extending as far south as Banks Peninsula. The large evergreen glossy leaves are a valuable forage for cattle in times of scarcity, the boughs being then cut down by the settler to enable stock to graze the leaves. The kernels of the fruit are certainly poisonous to man and some domestic animals The evidence as to the poisonous action of the fruit on cattle is conflicting, and certainly warrants further investigation. Pigs are possibly only slightly affected, but dogs are easily poisoned if given the entire kernels. The explanation of the apparently anomalous action on different forms of animal life is that the active principle of the "nut" consists of a cyanogenetic crystalline body which requires appropriate conditions before the poisonous prussic acid can be evolved. The conditions may exist in certain animals and not in others Thus the human and the dog are highly susceptible, but the pig and the ox are comparatively immune, from the effects of eating the fruit. The active principle "karakin" apparently requires that the enzymes present in the fruit shall be in contact with the principle before it can exert a poisonous effect, in this respect resembling the glucoside amygdalin, the principle of the bitter almond. Hence the pure principle "karakin" is only slightly toxic if at all, but the nut itself is deadly. What is of great interest is that the primitive Maori, who suffered from a deficiency of farinaceous foods, had here a supply of starchy fruit which would help to alleviate this deficiency, but was in the raw state inedible, bitter, and poisonous. By boiling or baking, the nuts became edible, palatable, and nutritious. One of the first things investigators ascertained in their endeavours to isolate the poisonous principle was that heating the extracts or original substance above the boiling-point of water destroyed the poison, thus confirming the wisdom of the Maori method for rendering the abundant supplies of nuts available for food.

(To be continued.)

The third conference of the New Zealand Grassland Association will be held at Palmerston North from the 2nd to the 5th October next. It will be opened by the patron of the association, His Excellency the Governor-General, whose deep interest in and wide knowledge of grass-farming activities are well known. The association cordially invites the attendance of farmers, merchants, and all others interested in grassland.

BARLEY FOR POULTRY FEEDING.

A COMPARISON WITH WHEAT.

H. A. KITTO, Overseer, Poultry Station, Wallaceville.

AN experiment was conducted at Wallaceville last year for the purpose of endeavouring to gain some first-hand information regarding the value of barley as compared with wheat when fed to laying birds. The results of this experiment were published in the August, 1933, issue of the *Journal of Agriculture.*

As it was fully realized that definite conclusions could not be drawn from the results of a single test of this nature, it was decided to repeat the experiment during the past year. In this test one hundred White Leghorn pullets were used. These were of similar age, bred from the same parent stock, and were selected as evenly as possible in regard to size, type, and points indicating laying-capacity and constitutional vigour.

Prior to the commencement of the test the hundred pullets were placed in one of two adjoining houses of the same size and design, and the birds were allowed to occupy the one house for several days, during which time they all received a similar ration—viz., whole wheat and barley. The day before the test commenced, fifty birds were drafted from the flock to the adjoining house without being handled, so that each lot of fifty birds was in possession of the quarters they were to occupy during the test.

The test extended over a period of forty-six weeks—viz., from 15th April, 1933, to 3rd March, 1934.

Sufficient food was weighed out at each weighing to last the birds for approximately ten days. The ingredients of the ration were kept in separate tin containers and apportioned out daily according to the birds' appreciation thereof. Any food left in the containers at the end of the test was weighed back and credited to the respective pens, so that the figures set out in Table 1 show the actual quantity of food consumed by each lot of birds during the test. For reference purposes the birds fed barley will be designated as Lot 1, and the birds fed wheat as Lot 2.

The rations of each lot were made up as follows:—

Lot 1.				Lot 2.			
Mash Mixture.		Grain.		Mash Mixture.		Grain.	
	lb.		lb.		lb.		lb.
Barley-meal ..	32	Barley ..	100	Wheatmeal ..	32	Wheat ..	100
Pollard ..	14	..		Pollard ..	14	..	
Bran ..	18	..		Bran ..	18	..	
Meatmeal ..	7	..		Meatmeal ..	7	..	
(approx. 10 per cent.)				(approx. 10 per cent.)			
Totals ..	71	.. ..	100	.. ..	71	.. ..	100

Table 1 shows the cost and amount of each of the food ingredients consumed by each lot of birds during the forty-six weeks of the test :—

Table 1.

Foodstuffs.	Average Prices.	Amounts consumed.	Cost of Foods used.
	Lot 1 · Barley-fed Birds		
	£ s. d.		£ s d.
Barley-meal ..	7 17 0 per ton ..	743 lb ..	2 18 4
Pollard	6 5 6 per ton ..	325 lb. ..	1 0 4$\frac{3}{4}$
Bran	5 17 4 per ton ..	418 lb ..	1 4 6$\frac{1}{4}$
Meatmeal	8 6 1 per ton ..	325 lb ..	1 4 1
Barley .. .	0 3 5·35 per bushel	49·36 bushels	8 10 1
Total cost ..	..	..	14 17 5
	Lot 2 Wheat-fed Birds.		
Wheatmeal	8 0 0 per ton ..	720 lb. .	2 17 7$\frac{1}{4}$
Pollard	6 5 6 per ton ..	315 lb ..	0 19 9
Bran	5 17 4 per ton ..	405 lb . .	1 3 9
Meatmeal	8 6 1 per ton ..	282 lb. ..	1 0 11
Wheat .. .	0 4 5·25 per bushel	41·6 bushels	9 4 7$\frac{1}{4}$
Total cost ..	..	..	15 6 7$\frac{1}{2}$

Table 2 shows details of the number of eggs laid each month (in dozens), the average monthly prices received per dozen for the eggs, and the total net proceeds received each month during the period of the experiment.

Table 2.

Monthly Egg-yield, in Dozens.		Average Price per Dozen	Proceeds received Monthly.
		Lot 1 Barley-fed Birds.	
1933		s d	£ s d
April	21$\frac{5}{12}$	1 11·11	2 1 8$\frac{3}{4}$
May	25$\frac{5}{12}$	1 10·70	2 8 1
June	31$\frac{4}{12}$	1 7·59	2 11 0
July	50$\frac{5}{12}$	1 5·68	3 14 3$\frac{1}{2}$
August	75$\frac{1}{12}$	0 11·99	3 15 0$\frac{1}{4}$
September	89$\frac{6}{12}$	0 10·06	3 15 0$\frac{1}{2}$
October	89$\frac{8}{12}$	0 10·71	4 0 0$\frac{1}{2}$
November	81$\frac{10}{12}$	0 10·70	3 12 11$\frac{1}{2}$
December	80	0 11·75	3 18 4
1934.			
January	75	1 0·94	4 0 10$\frac{1}{2}$
February	63$\frac{3}{12}$	1 2·04	3 14 0
March	5$\frac{11}{12}$	1 2·30	0 7 0$\frac{1}{2}$
Total amount received for eggs		..	37 18 5
Total cost of foodstuffs used ..		..	14 17 5
Total profit over cost of production		..	23 1 0

Table 2—continued.

Monthly Egg-yield, in Dozens.		Average Price per Dozen.	Proceeds received Monthly.
Lot 2. Wheat-fed Birds.			
1933.		s. d.	£ s. d.
April	$22\frac{9}{12}$	1 11·11	2 3 9¾
May	$30\frac{11}{12}$	1 10·70	2 18 5¾
June	$31\frac{1}{12}$	1 7·59	2 11 1¾
July	$53\frac{8}{12}$	1 5·68	3 19 0¾
August	$67\frac{11}{12}$	0 11·99	3 7 10½
September	$80\frac{4}{12}$	0 10·06	3 7 4
October	$88\frac{2}{12}$	0 10·71	3 18 8½
November . ..	83	0 10·70	3 14 0
December	77	0 11·75	3 15 4¾
1934.			
January	$72\frac{7}{12}$	1 0·94	3 18 3¼
February .. .	$58\frac{5}{12}$	1 2·04	3 8 4¼
March	$5\frac{10}{12}$	1 2·30	0 6 11½
Total amount received for eggs		.	37 9 4½
Total cost of foodstuffs used ..		..	15 6 7½
Total profit over cost of production		..	22 2 9

Table 3 gives a summarized statement of the experiment, covering the forty-six weeks' period.

Table 3.

Total Eggs laid and sold (in Dozens).	Amount received for Eggs.	Total Cost of Food.	Total Profit.	Cost of Food per Bird.	Cost of Feed to produce a Dozen Eggs.	Gross Profit per Bird.	Average Number of Eggs laid per Bird for Test.
Lot 1. Barley-fed Birds.							
	£ s. d.	£ s. d.	£ s. d.	s. d.	d.	s. d.	
689 ..	37 18 5	14 17 5	23 1 0	5 11½	5¼	9 2½	165·36
Lot 2. Wheat-fed Birds.							
$671\frac{11}{12}$ ..	37 9 4½	15 6 7½	22 2 9	6 1½	5½	8 10¼	161·26

Notes on the Experiment.

During the test both lots of birds ate their food well, and generally presented a healthy appearance throughout. At no time did Lot 1 show the slightest disinclination to eat the barley provided.

Unfortunately, a number of birds in each pen went into a moult shortly after being penned. The change of quarters and the unfavourable weather conditions experienced soon after the commencement of the test were no doubt responsible for the occurrence of this undesirable moult.

As was the case in the first experiment, it was noticed, when this one had extended over a period of about six months, that

Lot 1 presented a sleek, tight-feathered appearance, which was maintained until well after the termination of the test and right up until moulting-time.

Lot 2 showed more or less loose feathering as compared with Lot 1, and a more bulky appearance, but the contrast between the two lots of birds in this respect was not nearly so marked as in the former test. The fact that the whole of the birds taking part in this experiment had barley included in their ration after they had attained an age of about eight weeks was probably responsible for all the birds maintaining a more even appearance than was the case in the former test, as in this one no barley was provided to any of the birds during their growing-stage.

From observations made during both tests it appears safe to assume that the feeding of barley has a decided influence in encouraging the desired tightness of feathering in a laying bird.

Both lots of birds received two meals of mash daily—one in the early morning and one at midday.

The grain ration was fed in the evening, and, in order to induce the birds to exercise, this was well scattered in deep litter and in such a way that the birds were compelled to scratch and work to find the hidden grains. All birds were provided with as much food as they could eat at each meal without waste.

Broken oyster-shell and stone grit was always available for the birds to pick at.

Green food, consisting chiefly of succulent silver beet and young green oats, was fed daily and in abundance between 8 and 9 a.m. In addition to the meatmeal used in the mash, this material was supplied in hoppers placed in each house, and was available at all times for the birds to eat if so desired. The barley used in both experiments was Chevalier of high-grade quality, and was imported from Australia. The relatively low cost at which barley of this class could be purchased early in the year 1932 as compared with what is commonly known as fowl-wheat was chiefly responsible for the first experiment referred to being conducted as a means of ascertaining the respective values of the two kinds of grain when fed to laying birds.

Meatmeal, in addition to that used in the mash, was placed in a hopper in each house, and left before the fowls at all times. Lot 1 consumed from the hopper during the test a total of 159 lb. of meatmeal, 89 lb. of which was eaten between 1st August and 30th November. Lot 2 consumed from the hopper during the test 123 lb. of meatmeal, 68 lb. of which was consumed between 1st August and 30th November. It is of interest that both lots of birds consumed a greater amount of meatmeal during the four main laying months of the year than they did during any other period of the test.

A comparison of the egg-yields from both lots shows that Lot 1 produced 8,268, or 689 dozen, as against 8,063, or $671\frac{11}{12}$ dozen laid by Lot 2, being a difference of 205 eggs, or $17\frac{1}{12}$ dozen, in favour of the barley-fed birds. The respective averages per bird in each pen are: Lot 1, 165·36 eggs; Lot 2, 161·26 eggs.

It will be seen from Table 3 that the cost of producing each dozen eggs was $5\frac{1}{4}$d. in Lot 1 and $5\frac{1}{2}$d. in Lot 2, while the cost

of the foodstuffs consumed by each bird was 5s. 11½d. in Lot 1, against 6s. 1½d. in Lot 2, over the whole forty-six weeks' test.

The respective profits per bird over the period are seen to be 9s. 2½d. for Lot 1, against 8s. 10¼d. for Lot 2, a difference of 4¼d. per bird in favour of those barley-fed.

The difference of 9s. 2½d. between the total costs of foodstuffs consumed by each lot of birds is again in favour of the barley pen, but this is only a comparatively small margin—not nearly so great as last year. This is accounted for mainly by the fact that 6s. per bushel was the cost o wheat last year, while for the experiment this year the cost of wheat was 4s. 5¼d. Barley was a little cheaper for the second experiment than it was for the first, but not in the same proportion as the wheat.

The total net proceeds received for eggs from the barley pen is slightly higher than from the wheat pen, being 9s. 0½d. in favour of barley

Reading the cost of foods together with the proceeds received, a difference of 18s. 3d. in the total net profits is revealed in favour of the barley over the whole period of forty-six weeks.

As in the experiment last year, the cost of oyster-shell and stone grit has not been debited in the returns. This, however, would not amount to more than 12s. to 14s. for each lot of birds.

AGRICULTURAL LIME CARRIED BY RAIL, 1933-34.

THE figures relative to lime carried by rail during the year ended 31st March, 1934, show an increase for the whole Dominion of approximately 10 per cent, compared with similar figures for 1932–33 The increases for the North and the South Islands being approximately 5 per cent and 15 per cent respectively. The Dominion total represents an increase of nearly 20,000 tons, and is the highest yearly tonnage of which we have records.

Up to 1930–31 the total for the South Island was invariably higher than that for the North Island, but since then the North Island totals have invariably been higher. Of interest also is the progressive increase of North Island figures from 23,000 to 100,000 tons in ten years

Details, in tons, of quantities carried annually since 1st April, 1924, are as follow :—

Season.	North Island.	South Island.	Total for Dominion.
1924–25	23,265	68,241	91,506
1925–26	26,303	76,596	102,899
1926–27	29,474	71,230	100,704
1927–28	29,189	83,473	112,662
1928–29	42,258	99,858	142,116
1929–30	60,476	111,063	171,539
1930–31	72,678	83,168	155,846
1931–32	70,570	69,766	140,336
1932–33	94,701	79,413	174,114
1933–34	99,919	94,068	193,987

LEONARD COCKAYNE.

By the death at Wellington on the 8th July last of Dr. Leonard Cockayne, C.M.G., F.R.S., Hon. D.Sc. (N.Z.), Ph.D., F.L.S., F.N.Z.I., New Zealand has lost a savant whose eminence was a cause of profound national pride and whose work was of incalculable national value. In his chosen sphere, botany, his international ranking paralleled that of such other eminent workers as Lord Rutherford and Sir John Salmond in their spheres of physical science and of jurisprudence respectively. Dr. Cockayne's exalted status in the scientific world was due essentially to the fact that in ecology, the newest and, economically, the most valuable branch of botany, he was recognized by his co-workers as not merely a world pioneer, but a world leader. Ecology has been described briefly by Dr. Cockayne himself as "The class of research which deals with living plants and their relation to their surroundings, and which gathers its data from actual observations in the field."

Therefore it is fitted to provide "a more accurate knowledge regarding the maximum and minimum requirements of each economic plant and its behaviour when growing in company with other plants and animals" From this it follows not merely that ecology, if properly applied, would increase efficiency in agriculture, but also that all successful farmers actually are practical ecologists. The value of ecology lies in the fact that it tends to convert empirical or rule-of-thumb knowledge into knowledge based upon understanding and correlated with established principles. The relation between empiricism and ecological method has been clearly exemplified by Dr. Cockayne in the following words:-

"A certain method of treatment for a certain sand area may prove efficacious by the method of 'Try this, or that, and something good may turn up.' But let the result of this system be applied to another dune area where the supply of sand is rather greater, the climate rather drier, and the average angle at which the sea-wind strikes the dunes rather less oblique; the method so successful elsewhere fails at once. But attack the dune problem ecologically; study accurately the tactics of sand when exposed to wind; study also its physical properties, the relation of the natural plant-covering of various types of dunes to moving sand, the climate of the area, the evolution of the vegetation from that of the unstable sandhills to those quite fixed by vegetation, and so on; find out exactly how Nature works under the many conditions that dunes offer; note exactly the plant-forms which can survive different degrees of sand-advance; then, when these preliminaries are fully mastered, with some degree of confidence the investigator can attempt the 'reclamation' of a dune area, and, adding to his ecological knowledge by further observations and experiment, is finally in a position to draw up for agriculture those rules for dune culture which alone can fully succeed."

From this illustration one can readily conceive ecological methods being applied to some of the major problems of both the principal and the subsidiary rural industries, and it becomes apparent that under suitable direction the findings of ecology are fitted to advance agriculture in its many phases. The influence of Dr. Cockayne's work

THE LATE DR. LEONARD COCKAYNE, C.M.G., F.R.S., HON. D.SC. (N.Z.), PH.D., ETC.

provides much further evidence of this . it has supplied many of the fundamental conceptions underlying the work of officers of the Department of Agriculture, of the Plant Research Station, of the Forestry Department, and of other institutions similarly concerned with the scientific study of primary industries.

In addition to pioneering fundamental conceptions upon which much doctrine and investigation depends, and will depend in the future, Dr. Cockayne made to our knowledge direct additions of great economic value. Outstanding among these in the agricultural sphere is the monumental work relative to the montane tussock grassland of New Zealand—an area of some 6,000,000 acres which is the main grazing-ground of the nationally valuable mountain flocks of the South Island. In this work his remarkable array of talents, which led to his eminence in science, was necessarily exercised and strikingly illustrated, for the work called for an association not only of such mental attributes as scientific outlook, business acumen, and constructive imagination, but also of unlimited physical energy, and all these in a man of well over sixty years of age.

That Dr. Cockayne's montane tussock grassland work promises to be a botanical classic is to some extent indicated by the fact that as lately as December last it was cited in the recently founded *Empire Journal of Experimental Agriculture.*

During his widespread field studies of New Zealand vegetation Dr. Cockayne established the fact that wild hybrids are prevalent in many genera. The significance of this for forestry he realized, and indicated in his monograph of the beeches , for agriculture it has an important bearing on the work being developed in endeavours to secure improved strains of grasses.

Further work of Dr Cockayne that was of direct and great economic value to our primary industries related to the flax *(Phormium)* industry, to the management of New Zealand's comparatively extensive sand areas, and to her valuable forests.

During his lifetime merited scientific honours were freely bestowed upon Dr. Cockayne, but the crowning honour was the award by the Royal Society of England of the great Charles Darwin medal, relative to which the famous New-Zealander Lord Rutherford indicated a similarity in merit between Dr. Cockayne's outstanding work and that of Darwin himself.

It is natural in this *Journal* for emphasis to be placed on the value of Dr. Cockayne's work to the rural industries, but in point of fact his genius and erudition reached so widely that the sphere of his influence has been truly national. In the realm of pure science and in that of horticulture, by personal inspiration as well as by writings, always clear and forceful and often delightful, he has made a profound and lasting impression on national culture. Happily public appreciation of this was expressed during his lifetime not only in the scientific honours, but also in the civic honours, which rightly were given him.

At Mangawhata, Manawatu, eighteen months ago, Marlborough lucerne was sown side by side with imported seed to which it is superior markedly in growth and vigour.

PRODUCTION OF WILT-FREE BEANS.

W. D. REID, Plant Research Station, Palmerston North.

IN a previous paper on the bacterial wilt of beans* the morphology and identity of the causal organism and symptomatology and control measures of the disease were discussed. The paper indicated that, as this disease is seed-borne, two possible methods of control are available: (1) Seed-disinfection, and (2) use of disease-free seed. So far numerous trials by the Field Mycologist have failed to evolve a suitable seed-treatment. On the other hand, the production of disease-free seed has been secured by selection, and this supplies a practical method of obtaining disease-free crops. This paper records the methods adopted during the last three seasons. During the third week of October, 1931, trials were sown at the Plant Research Station area by the Agronomist to determine the numbers of commercial lines which had become infected during the initial outbreak of the previous season. Seventy-one lines of different varieties, together with six diseased controls, were sown. The majority of the plots consisted of five drills of eleven yards each, separated from the adjoining plots by three drills of barley. The remaining plots comprised three drills of 1 chain each separated from the next plot by two drills of potatoes. By this arrangement each plot was enclosed by a wind-break of barley or potatoes.

Bacterial wilt first appeared on the 3rd December as primary leaf lesions in four plots. Thereafter, more particularly during a warm moist period from the 3rd to the 10th December, many more plots produced initial outbreaks, from which infection of surrounding plants was rapid. Initial outbreaks were characterized by ooze on the stems of stunted plants, and secondary infections by typical lemon-yellow lesions on the young secondary leaves. Leaf lesions remained the chief symptoms of infection up to the 25th January, after which pod lesions appeared as the most obvious symptom of the presence of the disease. Owing to the rapid spread of the disease, the determinations of the presence or absence of primary leaf and stem lesions—as indicators of seed-infection—were not reliable, and consequently the trials did not give accurate experimental results. However, the following conclusions were derived from the season's observations: (*a*) The disease was, with the exception of one line of butter bean, confined to lines of seed of Canadian Wonder varieties.† (*b*) Canadian Wonder and butter bean varieties were readily infected from adjacent diseased plots. (*c*) Epicure, Zebra Runner, and Scarlet Runner varieties did not exhibit any symptoms of infection at any period during the season.‡

The regular examinations of the plots also provided data on the symptoms, the dissemination of the disease, and the effect of rogueing certain plots. These are briefly discussed, as they had a definite bearing on the elimination of the disease.

* Reid, W. D. "A Bacterial Wilt Disease of Beans." *N.Z. Journal of Agriculture*, Vol. 43, pp. 408–415, 1931.

† The Canadian Wonder variety refers to typical Canadian Wonder beans and similar varieties as Green Pod, Long Pod, Kentucky Wonder, &c.

‡ In the previous paper the Scarlet Runner bean was proved susceptible to this disease.

Symptoms of the Disease.

As shown in the previous paper, the first symptoms consist of small ⅛ in. angular dark-green lesions on both surfaces of the primary leaves. Infections generally occur in small patches of three to four plants, one or more of which always exhibit typical water-soaked stem lesions, usually with whitish ooze adjacent to the cotyledon leaves. These

FIG. 1. SEEDLING INFECTION, SHOWING GLOBULES OF OOZE INDICATED BY ARROWS.

plants usually wither, blacken, and die, but remain a source of infection for surrounding plants. The secondary and more noticeable symptoms are the "halo" spots on the secondary leaves. These lesions are more or less circular light-coloured areas ¼ in. to ½ in in diameter, with a small dark-green glistening central portion which is visible on both

leaf surfaces. After twelve to fourteen days and with the increasing vigour of the healthy plants infection takes the form of bright lemon-yellow leaf lesions, $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. in length, irregular in shape, and

FIG. 2. PRIMARY-LEAF LESIONS OF BEAN SEEDLING.

always containing the small angular dark-green shining portion about $\frac{1}{16}$ in. in diameter. The yellow leaf lesions are the predominating symptoms of infection for the greater part of the season.

Pod lesions were first observed in the second week of January as circular dark-green water-soaked areas, $\frac{1}{8}$ in. in diameter, usually with a central minute head of ooze. These lesions gradually extend in area, and, should they coalesce with adjacent lesions, often affect large portions of the pod. These lesions on green pods are normally covered by a slimy film of bacteria.

Dissemination

To prevent possible dissemination by implements, all cultivation was discontinued after the first appearance of primary-leaf lesions. The disease appeared to spread rapidly, but an early study of each plot showed that the majority of affected plants were adjacent to points of primary infections and that at this stage the amount of disease was governed mainly by the number of seedling infections. The spread of the disease consisted of a slow progression from these centres of infection, generally along the drills. Where growth was luxuriant, and plants in adjoining drills were touching, the disease spread radially at more or less an even rate. One week to ten days (a time which coincides with the incubation period of the disease) appeared to be sufficient for the disease to spread from an infected plant over an orbicular area 2 ft. to 3 ft. in diameter.

Dissemination was governed by the distance between infected and non-infected plants or areas. It was found that a distance of 2 ft. 4 in., occupied by three drills of barley, was insufficient to prevent cross infection. A separation of 7 ft., occupied by two drills of potatoes, also permitted cross infection, but to a much less extent than the 2 ft. 4 in. break. A distance of 2 chains prevented cross infection. It is not suggested that under all conditions a separation of 2 chains is a safe barrier to transmission of the disease, but it does indicate that the range of spread is limited. The spread of the disease in the field is believed to be due chiefly to insects (aphides, leaf-hoppers, &c.), and in part to wind and implements, but has not been verified by experimental evidence.

In order to restrict the spread of the disease, removal of infected plants was adopted. At first only the plants with lesions were removed, but experience showed that for the eradication of all infected plants it was necessary to remove all plants within a radius of 2 ft. or 3 ft. of a plant with visible lesions. This procedure reduced the recurrence of disease in rogued plots, and a more thorough examination and rogueing was then adopted in an attempt to obtain disease-free crops. The success of rogueing also depended on the percentage of primary infections and on the closeness of the plants. In the above trials the seeding was approximately two bushels per acre, and in the majority of the diseased lines one to six points of primary infection were observed. In some heavily infected plots 10 per cent. of the seedlings was infected, and such lines were removed shortly after the appearance of secondary lesions. The elimination of the disease was most readily obtained in those plots sown as three drills of 1 chain length. The result of rogueing provided many lines free from disease, for, in addition to the removal of infection in diseased lines, this rogueing also prevented spread to clean crops.

In the following season fifteen of these lines were sown at the Plant Research Station farm, the Tangimoana Forest Reserve, and a section within the residential area of Palmerston North City.* In

* These plots were sown with disease-free seed from rogued and unrogued plots.

these trials the seed was sown every 4 in. to 6 in. in drills 12 in. to 14 in. apart. Experience showed that wider spacing of seed and drills would have been advisable. The Tangimoana Forest Reserve is a sand-dune area, and the isolation plots were several miles from the nearest cultivated land. At no time did bean-wilt appear in the four lines sown in this locality. At the Station farm two of the plots were

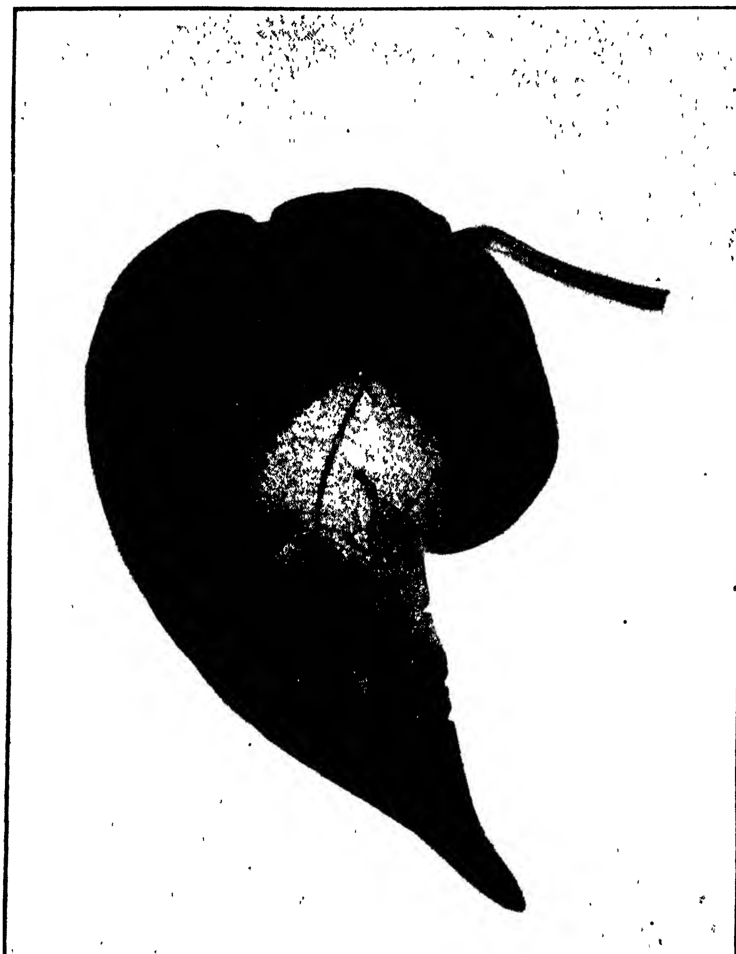

FIG. 3. TYPICAL LEMON-YELLOW LEAF LESION ON SECONDARY LEAF.

within 2 chains of an infected control crop, while at the city area the plots were approximately ten yards apart and the area was within a few chains of neighbouring vegetable-gardens. The disease occurred in five of the eleven plots in these areas. The symptoms appeared only as secondary-leaf lesions one month to two months later than in the infected control. Three of the infected crops were the progeny of

crops which had remained free of the disease during the previous season. Cultivation ceased as soon as bean-wilt appeared, and rogueing of the initial outbreaks prevented further spread within the plots and areas.

At the close of the season 24 lb. to 40 lb. of seed was harvested from each plot; ten of the plots had remained clean, and five were, after removal of the diseased plants, believed to be free from infection.

In the 1933–34 season further trials were carried out, but more care was exercised in obtaining isolated areas. Further areas were utilized at the Tangimoana Reserve, and all of these produced disease-free crops. Six other localities at a distance of not less than five hundred yards from market or homestead gardens were selected on private farms and farms established under the Small Farm plan. The seed used was harvested from some of the crops mentioned above, three of which had been infected and rogued in the 1932–33 season, one of which had been infected and rogued in the 1931–32 season but not infected in the following year, and two of which had remained clean during these two seasons. The areas varied from $\frac{1}{8}$ acre to 2 acres, and were sown, cultivated, and harvested by the farmer. This Station carried out periodical examinations for the presence of bean-wilt. The seed was sown in 14 in. to 48 in. drills, seed 4 in. to 6 in. apart. Bean-wilt was not observed in any of these crops. On account of the unfavourable weather conditions some of the crop yields were poor, and two crops failed to reach maturity, but the trials have demonstrated the practicability of producing disease-free seed.

SUMMARY.

Trials with diseased and disease-free lines of bean seed sown during the last three seasons are discussed. The typical symptoms of bacterial wilt of beans are given—i.e., stem lesions, primary-leaf infections, secondary-leaf infections, and pod lesions.

The dissemination of the disease is limited, rarely spreading for distances greater than 2 chains. Rogueing of diseased plants has proved successful in eliminating the disease, and with adequate isolation disease-free seed has been produced under normal farming conditions.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR THE YEAR 1933–34.

LISTS of butter and cheese manufacturing companies (co-operative and proprietary) which have obtained for their export produce an average grade of 93 points and over for the past dairy year—1st August, 1933, to 31st July, 1934—are given below.

Butter-factories included in this list number 102, as compared with ninety for the previous year, eighty-three being situated in the North Island and nineteen in the South Island. No less than thirty of these averaged over 94 points, as compared with twenty-four for the previous year, the highest individual average being 94·875.

As indicative of the general improvement in cheese quality during the year, twenty-seven cheese-factories obtained a place in the list, as compared

with seven for the previous year. Of this number thirteen are located in the North Island and fourteen in the South Island.

Company or Proprietor	Registered Number.	Brand	Tonnage graded.	Average Grade.
Butter-factories.				
Rangiwahia-Ruahine	750	Quail	273	94·875
Levin	910	Lake	1,454	94·814
Rangitikei	1360	Rangitikei	833	94·785
Golden Bay	620	Sovereign	620	94·755
Taieri and Peninsula	54	Peninsula	62	94·740
Inter-Wanganui	6	Inter-Wanganui	199	94·652
Lepperton	49	Lepperton	141	94·613
Awahuri	664	Red Rose	1,066	94·562
Wangaehu	1326	Wangaehu	656	94·511
Midhirst	110	Rugby	1,373	94·506
Uruti	300	Uruti	268	94·429
Rongotea	8	Rongotea	862	94·418
United	1220	Wharıti	204	94·403
Moa Farmers	341	Inglewood, Heath	1,349	94·385
Arahura	1516	Arahura	110	94·385
Rata	938	Rata	1,168	94·365
Shannon	1489	Shannon	1,202	94·357
Kaikoura	302	Kai	334	94·287
Mangorei	345	Mangorei	939	94·264
Okau	872	Okau	238	94·255
Tamaki	1463	Bell	357	94·165
Masterton	1307	Masterton	838	94·143
Tikorangi	102	Shield	469	94·133
Maketawa	342	M D C	317	94·120
Kokotahi	1144	Kokotahi	128	94·116
West Coast Farmers	675	Silver Pine	77	94·109
Omata	82	Omata	521	94·099
Waitara	726	Waitara	551	94·068
Tarata	631	Tarata	143	94·047
Tarurutangi	728	Champion	132	94·000
North Taranaki	723	Flax	612	93·997
Taieri and Peninsula	1234	Peninsula, &c	248	93·936
Wairoa	1345	Wairoa, &c	650	93·932
Murchison	1888	Airship	155	93·844
Karamea	1570	Karamea	190	93·829
Bell Block	488	Bell Block	192	93·819
Ruawai	66	Ruawai	1,531	93·769
Kaitaia	1298	Kaitaia	1,602	93·759
Kaikohe	40	Kaikohe	267	93·734
Taihape	1188	Tikapu	582	93·722
Whakaronga	1709	Whakaronga	203	93·719
Mauriceville	14	Mauriceville	834	93·713
Kairanga	1768	Longburn	668	93·704
Stratford	68	Stratford	1,119	93·702
Okoia	413	Okoia	1,206	93·687
Farmers' Dairy Federation	336	Murihiku	486	93·683
Norsewood	600	Norsewood	946	93·671
New Zealand	291	Anchor, &c	1,867	93·661
Collingwood	1254	Golden Hills	137	93·652
Tolaga Bay	1007	Tolaga Bay	268	93·647
New Zealand Farmers' Dairy Union	100	Hinemoa	1,067	93·579
Municipal Milk Depot	202	Rahui	133	93·579
Ngatiporou	395	Nati	653	93·577
Kuku	905	Ohau	140	93·576
Hauraki Plains	1900	Hauraki Plains	63	93·558
Apiti	414	Apiti	353	93·540
Eltham	31	Eltham	849	93·515

Company or Proprietor.	Registered Number	Brand	Tonnage graded.	Average Grade
		Butter-factories—*continued.*		
Te Aroha - Thames Valley	344	Overseas	1,953	93·515
Maungaturoto ..	1407	Otamatea . ..	934	93·513
Kia Ora	926	Kia Ora . .	1,461	93·505
Northern Wairoa ..	1358	Northern Wairoa .	2,427	93·496
Cheltenham	3	Pakeha	2,574	93·484
Alpine	792	Alpine . .	22	93·475
Taihape . ..	1188	Tikapu .. .	108	93·451
Farmers' Dairy Federation	165	Murihiku .. .	260	93·429
Co-operative Dairy Co of Otago	266	Huia ..	662	93·418
Konini	1203	Konini	542	93·384
Waitoitoi	20	Waitoitoi ..	73	93·383
Westland Cold Storage and Dairy Co.	145	Westland	98	93·376
Opotiki	337	Opotiki .. .	1,853	93·374
Golden Coast . ..	387	Golden Dawn .	33	93·360
Whenuakura	1237	Whenuakura .	188	93·339
Morrinsville .. .	330	Lockerbie, &c .	3,000	93·337
Kaipara . ..	794	Poplar .. .	2,319	93·329
Piopio . ..	603	Piopio .	748	93·316
Bay of Islands ..	1312	Bay of Islands .	1,072	93·311
Northern Wairoa ..	4	Northern Wairoa	727	93·310
Rodney ..	394	Rodney .. .	597	93·303
Rangitaiki Plains ..	133	Rangitaiki Plains ..	3,592	93·303
Mokau . ..	274	Mokau .. .	204	93·260
Hikurangi	303	Hikurangi	1,738	93·256
Heretaunga .	1230	Heretaunga, &c ..	1,358	93·248
Waitaki ..	1013	Waitaki	248	93·245
Bay of Plenty .. .	1399	Bay of Plenty	2,704	93·231
Matakana . .	1375	Matakana ..	296	93·207
Pahiatua . .	140	Pahiatua .. .	230	93·180
New Zealand	1458	Anchor, &c ..	1,096	93·179
New Zealand .	111	Anchor, &c	3,096	93·171
Tai Tapu ..	175	Tai Tapu, &c .	891	93·166
Featherston . .	360	Featherston	118	93·166
Manakau . .	815	Manakau .	211	93·150
Invercargill Dairy Co .	290	Rakiura ..	10	93·143
Port Albert ..	298	Port Albert .	587	93·127
Tariki ..	1818	Tariki . .	113	93·120
Whangarei	1720	Kauri ..	2,575	93·112
Raglan .	1470	Raglan .. .	579	93·101
Arawa .	1887	Arawa . .	559	93·061
Maungatapere . ..	1710	Moana .. .	775	93·044
Golden Coast . ..	991	Golden Coast ..	182	93·026
Caroline . ..	236	Caroline .. .	159	93·019
Aria	1734	A D C	180	93·019
Eketahuna . .	46	Eketahuna ..	1	93·000
		Cheese-factories.		
Omimi	74	Omimi	81	93·925
Westmere	1621	Westmere ..	399	93·707
Milton	1030	Milton	117	93·682
Little Akaloa	32	Little Akaloa ..	57	93·526
Lepperton	49	Lepperton.. ..	264	93·498
Marton	660	Marton	61	93·424
Oware	662	Oware . ..	164	93·422
Stirling	292	Stirling	450	93·311
Kaponga	1094	Kaponga	796	93·292
North Taranaki ..	212	North Taranaki ..	453	93·267
Kaimata	992	The Oaks	408	93·254
Milford	267	Milford	173	93·239
Rapanui	1714	Southern Grove ..	121	93·222

Company or Proprietor.	Registered Number.	Brand.	Tonnage graded.	Average Grade.
		Cheese-factories—*continued.*		
Lowgarth	629	Lowgarth	553	93·219
Kaitangata	1648	Kaitangata	127	93·192
Tisbury	701	Tisbury	169	93·181
Pahia	707	Pahia	161	93·170
Ngutuwera	753	Ngutuwera	158	93·132
Bell Block	71	Dove	191	93·117
Cardiff	10	C.C.C	624	93·102
Opouriao	1169	Opouriao	358	93·095
Switzers	802	Switzers	67	93·061
Edendale	36	Pioneer	620	93·037
Tussock Creek	313	Tussock Creek	27	93·023
Woodlands	1485	Woodlands	405	93·021
Kahui	493	Kahui	121	93·012
Orari	254	Orari	206	93·000

REVIEW.

Toadstools and Mushrooms and other Larger Fungi of South Australia: Part I. By JOHN BURTON CLELAND, M.D. Royal octavo, 178 pp. 6 coloured plates, 35 text figures: Government Printer, Adelaide.

THIS publication, covering the gill fungi (*Agaricaceae*), is one of a series of handbooks (No. 15, in fact) covering the flora and fauna of South Australia issued by the South Australian branch of the British Science Guild. Twenty-nine pages are devoted to an interesting general introduction, covering different aspects of the fungi, such as their role in nature, food-value, ecology, methods of preserving and identifying specimens, &c. The principal part of the work is devoted to a detailed taxonomic account of the gill fungi present in South Australia. Each species is carefully described, the descriptions being drawn by the author from fresh specimens collected by himself, and accompanied by ecological details of distribution, habitat, and edibility. For many years Dr. Cleland has been preparing careful records of these interesting plants, and, as evidence of the virgin nature of this field he has been exploring, it is shown that of the 287 species listed, grouped under 54 genera, no less than 179 are endemic, 160 being erected by the author, alone or in collaboration with Mr. E. Cheel. The classification followed is that of most recent specialists of the group. One valuable aspect of the work is the notes on the edibility of these Australian plants; for Dr. Cleland has personally tested, not without risk of agaric poisoning, all species which occur in sufficient numbers to warrant them being employed as food.

The study of this group of fungi has always proved difficult, as it is possible to identify and describe plants only from freshly collected specimens, a disadvantage which precludes comparisons being made with overseas species by overseas specialists. Consequently this book is especially welcome, as hitherto no reliable publication has been available to Australian mycologists. Many of the endemic species have been illustrated (about twenty being in colour) from drawings prepared from fresh plants by well-known botanical artists.

Unfortunately the book was published during times of economic stress. In consequence it has been printed in 10-point type, bound in paper covers, and much interesting matter, many valuable illustrations, and an index have been omitted so that the price (5s.) should be sufficiently low to place the work within the reach of all students.

The editorial preface states that the volume is one of a series prepared gratuitously by South Australian biologists and geologists. Dr. Cleland has earned the gratitude of students of the gill fungi by the production of this labour of love, representing the results of many years of arduous work, now generously given to the public.

G. H. C.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING AUGUST, 1934.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture The list supplements that published in the July and August issues of the *Journal*, and refers to those crops passed during August Further lists will be published in later issues

In the June *Journal* was published a list of growers who have received provisional certificates The acreage, percentages of foreign varieties present, and the group number and classification representing the relative merits of lines were given in that list, to which intending purchasers should refer

AUCKLANDER SHORT TOP

Mother Seed—

Adams Bros , Sheffield.
Barnett, A , Leeston
Carroll, A D, R M.D , Southbridge
Crump, F , R M D , Springston
Government Pure Seed Station, Box 4, Lincoln.
Heron, F , R M D , Rangiora
Jellie, J , Russley Road, Fendalton, Christchurch
Marshall, D , R M D , Leeston
Oliver, W R , Hororata
Poulton A D , R M D , West Eyreton
Rathgen, A E , R M D , Leeston
Roper, R S , R M D , Halkett
Wolff, R G , R M D , Horrelville
Wright, I T , Annat

Commercial Seed—

Anderson's Estate, Ladbrooks
Breitmeyer and McFarlane, Little River
Ferguson, J W , R M D , Winchmore
Guy, I A and E B, Yaldhurst
Haines, C , 108 Waimakariri Road, Christchurch
King, W H , Rosewill R D , Timaru
Martin, A , Box 12, Morven
Miller, G , Seadown, Timaru
Watson, R G and J. J , Springbank R M D , Rangiora (Line A)
Watson, R G and J J , Springbank R M D , Rangiora (Line B)
Wilson, M , R M D , Halkett

DAKOTA.

Mother Seed-

Adams Bros , Sheffield
Crozier, W J , Mount Hutt R M D , Rakaia
Gardiner, O J , Dunsandel
Government Pure Seed Station Box 4, Lincoln
Marshall, D , R M D , Leeston
Steele, J , R M D , Kimberley (Line A)
Wolff, R G , R M D., Horrelville

Commercial Seed—

Cross, H E , R M D , Weedons
Ellmers, J W , Kaiapoi
King, W H , Rosewill R D , Timaru
Miller, G , Seadown, Timaru.
Oakley, J T , R M D , Eiffelton (Line A)
Skurr, J. E , Sheffield
Steele, J , R M D , Kimberley (Line B)

ARRAN CHIEF

Mother Seed—

Griffin, J G , Te Waewae, Southland
Henderson Bros., Otapiri R M D., Southland (Line A)
Knowler, H., Te Waewae, Southland
Knowler, H. C., Te Waewae, Southland

ARRAN CHIEF—*continued*

Commercial Seed—

Bell, J F , Stirling (Line A)
Henderson Bros , Otapiri R M D , Southland (Line B)
Reid, W P , Maheno, via Oamaru
Saunders, E E , Studholme Junction (Line B)

ARRAN BANNER

Mother Seed-

Amyes, H C , R M D , Annat
Burgess, D , West Plains, Southland
Henderson Bros , Otapiri R M D , Southland
Milburn, M , R M D , Wright's Bush, Gladfield.
McAdam, H M R M D , Invercargill Glenco
Macalister, J G , Otapiri R M D , Winton.

Commercial Seed—

Manson, D J , Enfield, via Oamaru
Penn, F A , 154 Innes Road, Christchurch.
Porter, F , St Andrew's.
Roper, P F , R M D , Halkett

AUCKLANDER TALL TOP

Mother Seed -

Frost, C H , P O , Balcairn

Commercial Seed—

Miller G , Seadown, Timaru

KING EDWARD.

Mother Seed

Anderson, A , Stirling (Line A)
Burgess, D , West Plains, Invercargill (Line A).
Cox, S., Box 9, Willowbridge
Milburn, M , R M D , Wright's Bush, Gladfield

Commercial Seed—

Anderson, A , Stirling (Line B)

JERSEY BENNES

Mother Seed-

Penn, F A , 154 Innes Road, Christchurch

EPICURE

Mother Seed--

Robinson, R G , Box 4, Papanui, Christchurch
Shellock, W., Te Pirita R M D , Rakaia
Wright, I. T , Annat (Line B)

IRON DUKE.

Commercial Seed—

Herridge, F G , Woodend
Penn, F. A , 154 Innes Road Christchurch

BREESE'S PROLIFIC.

Commercial Seed—

Allen, A , R M D , Leeston.

GREAT SCOT.

Commercial Seed—

Government Pure Seed Station, Box 4, Lincoln.

—*Fields Division.*

On heavy land of good fertility at Halswell mangels sown with 2 cwt. an acre of superphosphate resulted in an excellent crop, except for a portion which inadvertently was not manured, and which gave a very poor crop.

SEASONAL NOTES.

THE FARM.

A Neglected Phase of Grass Farming.

OFTEN in practice the utilization, as distinct from the production, of feed on grassland does not receive as much attention as its importance justifies. Production of feed is only one phase of farm-management, and, if production of feed is not linked suitably with utilization, it can be said with certainty that the fullest possible returns will not be obtained from such measures as top-dressing, harrowing, and subdivision. Indeed, it may be stated correctly that measures intrinsically judicious, such as top-dressing, may be made practically futile by inefficient utilization of the additional growth of grassland which results from the top-dressing. Typical of the instances which could be quoted in illustration of this is the case of sheep-farmers who have increased their top-dressing programmes without increasing their flocks commensurately with the increased feed available in late spring and early summer as a result of the increased top-dressing. Such farmers have bewailed the detrimental influence of top-dressing upon fat-lamb production, although they have often been faced with the fact, rather difficult to explain satisfactorily, that the same type of top-dressing has given distinctly profitable results on adjacent essentially similar farms Usually such farmers should condemn not the direct influence of top-dressing, but their own imperfect utilization, in respect to which inefficiency has been intensified by the top-dressing In some districts last year favourable weather conditions in the spring and early summer brought about the result that has been attributed at times to top-dressing: because of the excessive amount of feed on hand some farmers in such districts could not satisfactorily fatten their lambs The corresponding result in dairying is a premature unduly rapid decline in butterfat production, at times because of deterioration in the quality of feed, consequent on a surplus supply, the decline in butterfat production which commonly characterizes the latter part of January has been recorded in early December and even in late November. Both in sheep-farming and in dairying the undesirable results cited have occurred because the feed available has been unsuitable for milk-production—while more than ample in quantity, it has been deficient in quality.

A further important phase of the same matter is that the results of inefficient utilization of grassland are not confined to poor returns from the feed produced, but under certain circumstances may readily bring about deterioration of the sward and a consequent decline in its productive capacity This is because poor utilization of grassland normally consists of both undergrazing in the late spring and summer and overgrazing in the winter and early spring—a type of grazing management which tends to a weakening of the species which produce feed early in the season and a strengthening of those which make relatively late growth. In the mixed swards characteristic of very extensive grassland areas, it leads quickly to the suppression of perennial rye-grass and to the dominance of species akin to brown-top and sweet vernal. Stated briefly, the trend of modern thought relative to grassland is that generally soil and climatic conditions do not govern the botanical composition of a sward so completely as is often believed, and that frequently the stock-grazing conditions are the real directing factor This generalization is not valid in respect to extreme conditions of soil or climate, when the influence of grazing management may be offset or masked by the greater influence of other conditions. But it is so widely valid as to justify more attention by farmers to the utilization in contradistinction to the production of the growth of pastures.

Many seem not to realize that poor utilization of pastures leads frequently to stock being badly fed at two critical periods annually, whereas under a system of good utilization the same number of stock could be comparatively well fed with an equal amount of feed; under poor utilization the feed is likely to be ample in quantity but lacking in quality in early summer, and lacking in quantity in winter and early spring. This is primarily because frequently 70 per cent. or more of the feed directly available from grassland is produced during the spring and early summer.

In the absence of good utilization the general result is the adoption, in respect to stocking, of a half-way course which brings about an unsatisfactory feed position both in the period of high production and in that of low production—understocking in the former period, overstocking in the latter.

To sum up, poor utilization not only has an undesirable influence upon the swards, but also leads readily to much poor feeding that could be avoided largely without any increase in the amount of feed produced. The essential facts as stated above seem so obvious and simple as to be scarcely worth mentioning until it is remembered that these facts, important though they be, often are not reflected in our farm practice. Fortunately, even in times economically difficult when occasionally it is necessary to abstain from outlay that is well justified there is no real reason why a general improvement in the standard of pasture-utilization cannot be effected—often greatly improved utilization may be brought about without either the introduction of difficult practices or the expenditure of much money. Unsatisfactory utilization arises largely from allowing pasture growth to become too rank, mature, and stemmy during spring and summer, and also from continuously grazing closely during winter and especially during early spring.

The Role of Ensilage relative to Utilization.

In many instances both of the conditions which lead to poor utilization of pastures, though radically different, can be corrected to a valuable extent strangely enough by the one operation—ensilage. Ensilage enables the summer surplus feed to be held for use during the customary period of shortage in winter and early spring Though ensilage grows in popularity—the latest official figures, those for 1932–33, disclose the greatest area yet recorded—there is still much room for profitable expansion in the area harvested annually for silage in most districts in which grass dominates farming. Ensilage seems too often to be viewed merely as a means of building up reserves of feed It is a valuable means of doing this, but it is at the same time possibly more valuable as a means of controlling and modifying the natural development of pastures in summer To be as effective as possible in this latter role, ensilage as a rule should be carried out at an earlier time than has been adopted commonly. Ensilage usually should be carried out before the time favoured for haymaking, which itself is generally too late. If ensilage is carried out at a suitable date there will be, firstly, the possibility of silage of better quality, and, secondly, the greater likelihood of a satisfactory vigorous, leafy aftermath, providing highly digestible feed when often it is sorely needed. In addition, ensilage, properly exploited, has a beneficial effect on all other pastures on a farm—by disposing of surplus growth it minimizes the development of mature growth on the farm as a whole, and the pastures tend to be more productive and leafy in the latter part of the summer than they would be otherwise.

Systematic Grazing desirable.

For the fullest efficiency in pasture utilization, it is necessary usually to link ensilage with well-planned grazing, which at times should be supplemented by the topping of any growth which, without such treatment, tends to run to seed-heads. As a rule, highly effective grazing management may

be achieved on farms on which nine to twelve fields of fairly even carrying-capacity are in pasture, and remarkably good results are being obtained on such farms. Full particulars about effective grazing and other aspects of pasture utilization may be obtained from local officers of the Fields Division, whose advice, based on a consideration of local conditions, is likely to be more helpful than would be the generalized guidance such as is possible in these notes.

To enable grazing to take place at the most suitable stage of growth it is necessary at an appropriate time to drop from the grazing programme any paddocks in excess of those required to meet the current feed requirement of the stock. Much of the poor utilization that is tolerated is due to not dropping enough of these paddocks or not dropping them soon enough. And it is the appropriate dropping of these paddocks which provides the scope for ensilage, for usually it is desirable to drop from the grazing more paddocks than could be utilized effectively for haymaking. Early closing of fields for ensilage is valuable in that it favours the possibility of early mowing, which in its turn gives greater probability of a good aftermath. A top-dressing with superphosphate at closing-time of fields intended for ensilage or haymaking is often advisable, especially in the case of fields not recently top-dressed.

The Potato Crop.

It is probable that annually more disappointments are experienced in respect to the potato crop than to any several other crops grown in the Dominion. Because of these disappointing crops the average potato yield is much lower than it need be. The average Dominion yield is between 5 and 6 tons an acre, and, when it is remembered that much of the land sown in potatoes yields 10 tons or more an acre, it is obvious that there must be many crops of miserably low yield.

There is abundant evidence that much of the occurrence of these " scrub " crops is due primarily to inferior seed. To remedy the position an official system of certification of seed potatoes was inaugurated a few years ago The need for certification arises from the fact that the essential characteristics of good potato-seed fall into two principal classes. One class includes characteristics which may be judged from the appearance of the tubers, such as the purity and maturity of the seed, the size and shape of the tubers, and freedom from such diseases as scab and late or Irish blight. The other class includes a very important characteristic about which the appearance of the seed tuber tells nothing in practice. This is the presence or absence of obscure troubles which are known as virus diseases, and which can be detected in the field only by personal inspection of the growing plants. The virus diseases may be looked upon as a primary cause of the so-called " running out " of potato varieties.

The association between virus infection and yield was well illustrated in a trial carried out last season at the Plant Research Station, Palmerston North. This trial primarily was designed to give growers information relative to complaints that had been received about the table quality of certain potatoes grown in the North Island. The complaints related particularly to the condition generally known as brown fleck. The trial not only clarified the brown fleck question, but also exemplified the connection between virus and yield. In considering the yields obtained in this trial, it is important to remember that the only variable circumstance was the productive capacity of the seed. In all other matters of consequence such as soil, manuring, and cultivation there was uniformity. Hence particular significance attaches to the range in yield.

The comparatively early strain of Sutton's Supreme, known as Aucklander Short Top, varied from 14 tons to 5 tons per acre. In the 14-ton crop there were 4 per cent. of diseased plants. In the 5-ton crop there were 44 per cent. of diseased plants or misses. Virus trouble was almost wholly, if not wholly, responsible for both diseased plants and misses. The late strain of Sutton's Supreme, known as

Ancklander Tall Top, ranged from over 16 tons to under 7 tons per acre. The 16-ton crop had 2 per cent of diseased plants, the poor yield was associated with 78 per cent. of diseased plants or misses. The Iron Dukes, which are also called Aberbrothock, ranged from 15½ tons to under ½ ton an acre. In the crop of heavy yield there was little virus trouble, while in the failure every plant was diseased. It seems worth stating again that the only variable factor with which these striking differences in yield can be associated is the virus incidence in the seed. From this it follows that the influence of excellent judgment in respect to soil and cultivation and judicious expenditure in respect to fertilizer can be completely neutralized by neglect relative to seed

The information yielded by the trial in respect to quality is also well worth consideration. Ten lots of seed were wrongly entered as Iron Duke: they really were Northern Star. In other lots Northern Star occurred freely as an impurity. The point of importance in this confusion relative to variety is that Northern Star is lacking in quality because of brown fleck, whereas good seed of Iron Duke is quite satisfactory in this respect Hence, if the growers were using the variety they believed they were using the complaints regarding quality would not have been received.

The question of practical importance is, " How can growers make sure of obtaining seed satisfactory in respect to virus trouble and true to name ? " The answer is, " Use certified seed." The great body of those who grow potatoes—that is, those whose crops are designed primarily to meet their own private needs—could well give more attention to the use of certified seed To facilitate this, certified seed is being sealed for sale in small lots—from 14 lb upward.

The cutting of seed potatoes at times leads to misses in the rows, due to the rotting of the cut portions Rotting is greatly minimized when conditions are suitable for the healing of the cut surfaces Dry conditions are particularly unfavourable for healing Hence, while it is good practice to cut and plant seed immediately into a moist soil it is not good practice to leave cut potatoes in sunlight or to plant them at once into dry soil. If cut seed are to be kept for a day or so they should be spread out loosely—as air facilitates healing of the cut surfaces—and covered with wet sacks. Of popular varieties, Aucklander Short Top, Aucklander Tall Top, Majestic, and King Edward do not heal readily after cutting, and so need special care.

Treatment of Cereal Seed.

It is very inadvisable to omit treating cereal seed suitably for the prevention of smut. For many years wet pickles such as solutions of bluestone or formalin were widely used for this purpose These, while definitely useful for holding the smuts in check, have at times led to injury to germination or to checking of the growth. Because of this, the modern tendency is to resort as far as possible to the use of various chemicals in dust form. The chief advantages of the dusts are the elimination of the danger of seed injury and the ease of treating and subsequently handling the seed. Disadvantages of the dusts are extra cost and the danger of injury to workmen carrying out the dusting. Regarding these disadvantages, it is well to remember that the extra cost is at most under a shilling an acre, and that dusting either can be done at home by suitable machines costing under £2 or be undertaken by seed-cleaning plants at a cost covering little more than labour and material.

Unless seed-treatment is carried out properly, it is very likely either to cause serious injury to the seed or to be ineffective as a means of reducing disease. Mistakes may relate either to the material used or the methods followed. As an example of this, copper carbonate dust, while

normally effective in wheat, is not effective with barley or oats. On the other hand, organic mercury dusts are effective for all smuts of cereals, except loose smuts of wheat and barley, which are controlled only by suitable hot-water treatment.

General Cropping Work.

As September is often a suitable time to close up lucerne areas, any delay in doing this as a rule should now be avoided. Early closing assists greatly in obtaining a comparatively early cut which generally is saved suitably as silage followed at about new year by a second cut which is valuable either for hay or green feed. A common result of early closing is an extra cut annually from the lucerne. A further important result in lucerne crops which are invaded by plants that outgrow lucerne early in season is the removal of the harmful competition of these plants which normally lucerne outgrows in the summer.

It is often worth while to sow in October an area of quickly-maturing soft turnips, such as Purple-top Mammoth, for use early in the new year. The yield from such an area may not be heavy, but it is likely to be particularly useful in obviating unduly rapid falling-off in milk-production. Shortly after the sowing of the early variety the remainder of the soft turnip area may be sown in late-maturing varieties such as Imperial Green Globe.

Kales, including chou moellier, or marrow-stemmed kale, have been sown with good results in October, when they have provided feed towards the end of January or the beginning of February. Later sowings of kales may well be made to yield feed for use in the autumn and winter. Strictly because of its merits, chou moellier has increased in popularity in recent years. A suitable sowing is 1½ lb. to 2 lb. of seed an acre sown broadcast or ½ lb. to ¾ lb in drills 2 ft. to 3 ft. apart. Chou moellier demands and deserves high fertility and usually responds very profitably to a dressing of 2 cwt. to 3 cwt. an acre of superphosphate on good land—a dressing which on land tending to be poor may often well be supplemented by 2 cwt. an acre of blood and bone.

Thorough preparatory cultivation should be the keynote of all cropping operations. Year after year much evidence is provided that potential returns from judicious action and outlay in respect to all other phases of cropping are far from fully realized because of inadequate cultivation.

—*R P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Control of Pests and Diseases.

By the time these notes appear, the blossom buds on most pome-fruit trees will be at about the open-cluster stage, while early flowering varieties, particularly of pears, will be at the pink stage, with a few of the early blossoms fully opened. This is one of the most important periods in the season for the application of fungicidal sprays, particularly for the control of powdery-mildew on apples and black-spot on apples and pears. Varieties of apple-trees that are subject to either of these diseases should receive at least two applications of lime-sulphur during the pre-blossom period, the first at the tight-cluster stage, at a strength of 0·2 per cent., and the second at advanced-pink stage, at a strength of 0·1 per cent.

For the control of powdery-mildew it is important to reduce the period between the last pre-blossom spray and the first post-blossom spray as much as possible. It is during this period that the disease often becomes established on the young growth. If the advanced-pink application is delayed until about 10 per cent. of the blossoms are fully open, and the petal-fall application made when only about 75 per cent. of the blossom

petals have fallen, there is little risk of the fungus becoming established during this dangerous period. The petal-fall spray should consist of the following combination: Lime-sulphur, 0·1 per cent.; colloidal sulphur, 2 lb. per 100 gallons; lead arsenate, 1½ lb. per 100 gallons

On pears, excepting for a few tender varieties, bordeaux mixture at a strength of 3–4–50 is recommended from this period onward.

The first and second applications after the petal-fall spray should be repeated at intervals of ten days and fourteen to eighteen days respectively. It is advisable to make later applications at intervals of fourteen to twenty-one days, and the only alteration needed in the mixture is a reduction in the strength of lime-sulphur to 0·083 per cent. These spray applications should be continued until mid-January or later according to conditions.

The nymphs of the apple leaf-hopper usually appear on the under-side of apple foliage during October, and by sucking the juices from the leaves prevent the foliage from functioning as it should. This injury is liable to be reflected in the size of the fruit and the development of fruit-buds for the following year. Control can be effected in the nymph stage by the addition of nicotine sulphate 40 per cent., 0·05 per cent. (1–800) to the fungicidal sprays mentioned above.

Stone-fruit trees will now generally be in bloom or have passed the blossoming period, and, no doubt, will have received the pre-blossom spray for the control of leaf-curl, bladder-plum, shot-hole, brown-rot, &c. The disease most likely to cause loss after this stage is brown-rot, but this loss can be prevented in a large measure by spraying with lime-sulphur, 0·083 per cent. plus colloidal sulphur, 2 lb. to 100 gallons. The petal-fall application is very important, and then follows a period when usually little trouble is experienced and an application every fourth week is all that is necessary The last month before the fruit ripens is the most difficult period in which to effect control, and applications should gradually be increased to intervals of ten to fourteen days as maturity approaches

With the first appearance of any kind of aphis, nicotine-sulphate 0·05 per cent. (1–800) should be applied Where it is intended to apply this specific alone, the addition of what is known as an activator is of importance. Hydrated lime or soft-soap are suitable activators when used at 3 lb. to 4 lb. per 100 gallons of spray. Should the application be made in conjunction with a sulphur spray, the addition of an activator is not necessary. It is suggested that the required amount of nicotine sulphate be placed in 2 to 4 gallons of water to which the activator has already been added, and allowed to stand for twenty minutes before fully diluting. This procedure of mixing will result in greater efficiency. More effective control will be obtained if the application is made on a hot day, consequently it is advisable, where possible, to await suitable conditions.

Refurnishing Apple-trees.

Refurnishing is a term used to describe a comparatively new method of working over a tree from one variety to another. This method is being experimented with by many growers in this and other countries. The object of refurnishing is to obtain a tree of the desired variety capable of producing a full crop of fruit in a much shorter space of time than is possible by the old method of cutting down the trees to near the base of the trunks and crown-grafting. Trees to be refurnished are prepared by reducing the leaders to about eight or less in number. All arms, laterals, and spurs are removed and the leaders reduced in height to a point where the wood is of suitable thickness for whip-grafting. Scions arranged spirally along the entire length and spaced about 1 ft. apart are inserted into the sides of all leaders. Several hundred scions are necessary in refurnishing a large tree.

There are many different methods of inserting the scions when refurnishing trees. A method that so far appears to be one of the most successful is known as the inverted L or side graft. A cut the shape of an inverted L is made in the bark, the corner of the L is raised and the scion pushed under

the uplifted portion of bark. The scion is made of the same shape as that used for rind grafting and held in position by a nail which is driven through the covering bark and the scion. Fine gauge nails about $\frac{5}{8}$ in. in length are suitable for the purpose. It is necessary to remove a small portion of bark above the heel of the L so that the scion will fit closely.

Some experimenters claim that in refurnishing it is preferable to place the scions on arms and laterals rather than on the leaders. However, time alone will produce more definite information on this point. With the inverted L system no bandaging is necessary and the operation is very simple. The wounds where the scions are inserted should be sealed with grafting-wax or thick crude petroleum jelly, the latter usually giving excellent results. Trees should be in the same stage of growth for refurnishing as for ordinary grafting, and the scions in a dormant state.

Pollination.

Good pollination plays an important part in the setting of fruit. Honey-bees are probably the most important of the pollen-carrying insects, consequently no orchard should be without a few hives. One colony of bees to every 2 acres of orchard should be the minimum number kept. In large areas the hives should be distributed in various parts of the orchard. This is most important when showery weather is experienced during the blossoming period, for usually when rain is threatening bees will not travel far from the hive. Certain varieties of apples and many varieties of pears and plums are largely self-sterile and require pollen from another variety to produce fertility. In such cases pollination may be assisted by taking blossom twigs from another suitable variety and suspending them in the trees requiring pollination. If the twigs are placed in containers with water they will remain fresh for several weeks.

Tree-supports.

In many orchards large fruiting limbs are broken each year for want of adequate support. In past years wooden props have been used generally for this purpose, and in some orchards they are still employed extensively. These props cause considerable inconvenience and are a heavy annual expense. A permanent system of wire-bracing is far preferable in every way Full details of a system of central wire-bracing fruit-trees appeared in this *Journal*, November, 1932. Any such permanent bracing should, if possible, be done before the blossoming period.

Fireblight.

A thorough examination for fireblight cankers should be made as soon as possible, more especially in pear-trees and hawthorn-hedges The first sign of new infection of fireblight is the wilting of blossom clusters and is to be expected especially in late-flowering varieties. Constant vigilance for the first sign of blossom infection is of the utmost importance in the control of the disease. The immediate destruction of infected blossom clusters, together with the spur on which the blossom is found, is the only means of control at this period Any such infection that may be found should also be immediately reported to the Orchard Instructor for the district so that efforts can be made to locate the hold-over canker responsible for the outbreak.

Miscellaneous.

Cultivation should be proceeded with as soon as the condition of the land will permit, and a good tilth secured early in the season. This practice renders cultivation unnecessary when the trees are in full bloom—such cultivation should be avoided when possible.

Fruit, particularly pears, in cool stores should be examined frequently, and marketed before they become overmature.

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

Some attention should now be given to the pruning of citrus trees. In many orchards there is considerable room for action in this respect. Overcrowding of branches, bare and useless wood, are matters that need attention. Sunlight and air are both very essential to maximum success, and without them proper development cannot take place. In old trees where branches are crowded some of them should be taken out, and, in addition to this, all exhausted and dead wood should be removed. All long laterals should be shortened, and this will have the effect of producing short fruiting-wood. The principal object in pruning should be to lead to the production of the maximum quantity of fruit in as compact a space as possible. Trees with a limited number of well-spaced leaders studded with suitably healthy laterals often will produce more fruit than those trees that are densely wooded. Further, it is more likely that the fruit will be of a higher quality and of more even size by reason of the fact that it has been produced under better conditions. Where planting has not been completed no time should be lost in getting the trees in position in order that they may become established before the hot and dry weather commences.

At this season of the year the trees will benefit greatly by receiving a liberal dressing of manure. As animal manure is practically unprocurable, it will be necessary to use artificial manures. It is very difficult to specify treatment that will give general satisfaction. Phosphates, potash, and nitrogen are all necessary for the tree and fruit. Where fertilizers such as superphosphate or blood and bone are being used, every effort should be made to have them turned under, as these fertilizers move down into the soil very slowly. However, sulphate of ammonia and nitrate of soda can be sown on the surface and worked in, as they are readily washed into the soil. Mature citrus trees require greater quantities of nitrogenous manure. As far as it is possible financially the application of fertilizers should not be neglected, as it will be quickly reflected in the health and vigour of the trees.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Hatching Chickens.

POULTRY-KEEPERS who have not yet the desired number of chicks hatched, or the last eggs for the season undergoing incubation, are reminded that chicks hatched later than the end of the present month, or early in October at the latest, seldom prove satisfactory. No time, therefore, should be lost in securing the required number of young birds for the season. In many cases hatching operations will probably be delayed for several weeks to come owing to the inability to secure broody hens. The wise poultry-keeper, however, who realizes the drawbacks of having late-hatched stock in the plant will not wait for broody hens. He will either adopt artificial methods of hatching or procure day-old chicks and rear these by means of an up-to-date brooder. It is now recognized that the maximum returns cannot be secured from poultry unless eggs are produced freely in late autumn and winter. It is also recognized that the pullets chiefly must be depended upon to produce eggs at these seasons, and to do so the chicks must be hatched by the end of September at the latest. The drawbacks of late-hatching are many, but these may be largely counteracted by placing the chickens under the very best conditions possible, such as in an orchard where good shade, shelter, and fresh ground are available. In addition, the food supplied should be of sound quality, and, above all, an abundant supply of succulent green material, that great essential for their welfare, provided for the young birds.

Ducks for the Farmer.

October is a very suitable month during which to hatch out the laying type of duck. The keeping of a small flock of ducks is a matter which should appeal particularly to farmers and small settlers, for it is on farms and small holdings, where plenty of range is available, that the maximum profit can be made from a flock of ducks of high laying-capacity. It may be said that ducks are heavy feeders, and with the present high cost of food will return a poor margin of profit over their keep. This may be true where the whole of the food they require has to be purchased. On the farm, however, it is entirely different, for where a free range is available, and particularly where there are creeks and the land is swampy, ducks will at most times of the year find a good deal of the food they require. Again, on the small holding where skim-milk or milk-curd is available this forms a splendid food for ducks of all ages.

Probably the two most popular breeds of duck in New Zealand at the present time are the Indian Runner and the Khaki Campbell The latter may be regarded as a much better dual-purpose breed than the former. Both of these breeds are good foragers, when given their liberty, and the worms, snails, and other forms of insect life, combined with green material picked up, make ideal food for promoting egg-production. Compared with fowls, the cost of accommodating ducks is much less. In most parts of New Zealand they do not need houses, as a low wire-netting fence about 3 ft. high erected in a dry, well-sheltered locality is all that is required. This is merely for the purpose of yarding the birds by night. Owing to the fact that ducks usually lay their eggs at night and drop them anywhere, the work of collecting would be a troublesome matter were the birds not enclosed, to say nothing of the eggs that probably would be lost. Ducks should be kept penned until about 10 a.m ; few, if any, eggs are laid later. Ducks are creatures of habit, and if given a good feed at a regular time in the evening they can generally be depended upon to come home and then they can be penned up for the night.

Hatching Ducklings.

If the temperature in the incubator at the level of the top of the eggs is maintained at 102° the first week, and at 103° from then onwards, the eggs should start to pip on the twenty-sixth day and hatch out from thirty-six to forty-five hours later. Far too many people became alarmed at the hatch being delayed for this length of time after the pipping stage, and attempt to assist the ducklings out of the shell. This is a great mistake, as opening the machine and interfering with the eggs in any way before allowing them well over their full time of hatching is only inviting trouble.

One of the secrets in hatching duck-eggs is the application of moisture. The best way of applying this is to spray water at a temperature of 103° on the eggs with the mouth every morning after the fourteenth day. It is advisable to do this after turning and immediately to place the eggs back in the machine. Do not cool after spraying. Spray in the morning, and cool at night.

Brooding Ducklings.

Ducklings being reared under artificial conditions should be given water to drink with the first meal, and from then onwards water should be left within reach of the birds during both day and night. It is of the greatest importance that after a long fast they be not given water until they have received a meal. Even then it is a wise course to provide water with the chill taken off. When ducklings are given a cold drink before food, and especially if they have been confined in a brooder without food, they are almost sure to suffer from staggers, followed by heavy mortality. Ducklings thus affected give every indication of being in a fit by falling on their backs with eyes twitching, and presenting generally a distressed appearance.

They sometimes behave in a similar manner and with serious losses when enclosed in an overheated, badly ventilated brooder. Even when ducklings are first placed in the brooder it should be so arranged that the desired heat can be secured without excluding fresh air. Good food and cleanliness are certainly essentials in rearing ducklings, but even these count for little if the birds are placed in a brooder that is insufficiently ventilated. During the summer season, artificial heat, if reduced by degrees, can usually be dispensed with altogether when the ducklings are about three weeks old. Climatic conditions must at all times be taken into consideration. In favourable weather the ducklings may be let out of the brooder and given a limited run both by day and night on the third day after removal from the incubator Food is not required for at least thirty-six hours after hatching The first meal may consist of equal parts of scalded bran and pollard mixed with a small quantity of oatmeal, to which a handful of fine grit should be added. The grit assists in the proper digestion of the food Feed this mixture four times a day, giving all the birds will clean up. When they are a week old the grit need not be mixed with the food, but may be kept in a shallow dish or tray, so that they may eat as much as they require. As they grow older grit of a coarser size should be supplied From the time they are a fortnight old they should be fed three times a day with equal parts of pollard, bran, and maize-meal, and it is advisable to continue giving this ration until the drakes are ready to kill. When the birds are a few days' old finely cut green food, such as lettuce, young tender grass, or silver beet, should be fed daily. If skim-milk is available it may be used to advantage for mixing up the morning mash

Although ducks are water-fowl, it is important in respect to old or young birds that their sleeping quarters be maintained in the driest possible condition, or leg-weakness and other troubles will result After about three or four days the water-vessels should be placed well away from the sleeping-quarters as a means of minimizing the wetting of the latter. At this stage the vessels should be of sufficient depth for the birds not only to wash off any food or dirt from their nostrils, but at the same time to give them a "good blow out" If the nostrils are allowed to clog the eyes become plastered, while lameness, weak back, and an unthrifty condition soon set in

On account of the thinness of their skulls, ducklings are very subject to sunstroke and giddiness, and therefore shade should always be provided When very young, as is the case with chickens, young ducklings should be marked for future age-determination. The best way of doing this is to take a V-shaped piece out of the edge of the web of the foot. This should be done with a very sharp knife, the foot of the duckling being held firmly on a piece of solid smooth board during the operation. Ducklings can be marked when leaving the incubator.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Seasonal Preparations.

OCTOBER is perhaps the month when the apiarist can most greatly help his bees to develop to full strength in time for the main honey-flow. In the warmer parts of the country swarms may be expected about the middle of the month, but in the southern districts they probably may not appear until three or four weeks later. By 1st October, unless the weather for some weeks has been cold and wet, every hive should have been examined and its condition noted with regard to stores, population, and health.

No colony should be allowed to dwindle because it has not sufficient food to provide for the offspring of a prolific queen. On the other hand, some beekeepers prefer that all the old honey in the hive should be used

up before the new season's flow commences. The food-supply of the hive is sometimes an exceedingly puzzling matter, as it varies considerably in accordance with the weather and the strength of the colony, and only periodical and systematic examinations can decide the question as to whether all is well with the hives in this respect. No harm can be done by feeding good white-sugar syrup, but a hive which is starved in the spring will probably not recover its strength till the main honey-flow is nearly over. By the middle of October, under normal weather conditions, every hive should have at least four frames of sealed brood, and many will have more. Those that have fewer, unless their food-supply is very short, should be marked for requeening as soon as possible. The apiarist's endeavour should be to keep his colonies as even as possible, thereby obtaining a uniform surplus throughout the apiary.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the month to treat any cases of foul-brood which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, as everything depends on locality and weather conditions. In some districts it would be most inadvisable for the beekeeper to treat his bees in October; in others, where suitable conditions prevail, treatment may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding. For full details see Bulletin No. 119 "American Foul-brood and its Treatment." This is issued free, and can be obtained from any of the Department's offices.

Hiving Swarms.

In most textbooks on beekeeping this type of advice is given: "When a swarm settles into a cluster take a light box and shake the bees into it," &c. Such advice is sound where the bees are accommodating enough to settle into a convenient position for the shaking process to be carried out Unfortunately, in many cases bees get into positions whence it is impossible to dislodge them so easily. Sometimes they will settle on a small bush, and much of the cluster will be on the ground. In this case probably the best thing to do is to place the box over the cluster, and if the bees do not show much disposition to climb up into the box they may be persuaded to do so by the use of a little smoke. When they cluster in the centre of a prickly hedge the box should be placed on one side of the hedge, and the beekeeper should puff smoke from the other side of the hedge, and thereby drive the bees towards the box. In the event of the swarm taking possession of a fencing-post and clustering on it from top to bottom, as they occasionally do, the smoke must again be used, and in addition it is as well to brush the bees from each side of the post in turn into the swarm-box, with the brush used for the frames at extracting-time.

The usual practice is to leave the box sheltered from the sun and covered with a sack near the place where the swarm has settled. Where few hives are kept this may be done with impunity, but if other swarms are expected it is well to remove the box to the place where the colony is to stand permanently, otherwise before the close of the day the probabilities are very largely in favour of the box being taken possession of by three or four other swarms—a matter of annoyance to the man who wishes to keep his swarms separate. In every case a swarm should be attended to as soon as it settles. Many people are under the impression that swarms should be left undisturbed till nightfall, but this idea is an erroneous one. They should invariably be placed in the box as soon as possible after the cluster is formed, and put so that they are sheltered from the rays of the sun.

Water-supply.

One of the most important of the minor details of apiculture is the provision of a constant water-supply for the purpose of assisting the bees in brood-rearing. Not only is it necessary to conserve the energy of the bees by having the water close at hand, but it is well to ensure that they do not prove a nuisance at taps, cattle-troughs, &c. From early spring till late autumn water is an absolute necessity to bees, and they will consume comparatively immense quantities in fine weather. It thus behoves the beekeeper to see that a liberal supply is always available. By establishing his drinking-fountain early in the season he will teach the bees where to go for supplies, and ensure their always seeking the same spot for water.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Plant Preferences.

CROP-PLANTS collected from many parts of the world bring with them a preference for the conditions of temperature, moisture, soil acidity, and foods to which they are accustomed. Successful cropping depends very largely in learning these requirements and supplying them. Recently improved methods of measuring the acidity of a soil have enabled important contributions to be made to our knowledge of the preferences of many crops in this respect. Many are aware of the fact that after a dressing of lime sufficient to neutralize the acidity of an acid soil, cabbage, cauliflower, broccoli, Brussel's sprouts, rape, mustard, and turnips, clovers and barley at times give much improved results. We have now to add sweet corn, tobacco, and egg plants to the list, the last two being members of the botanical order of *Solanceae*, many members of which are very tolerant of acid soil conditions. Recent reports indicate that even more sensitive to acid soil conditions than those crops mentioned above are asparagus, beet, celery, lettuce, onions, parsnips, spinach, leeks, salsify, and currants.

Many crops are less particular, and give satisfactory returns on soils slightly acid or alkaline. Under this heading are listed carrots, radish, cucumbers, endive, lentils, peas, pumpkins, marrows, water-melons, rhubarb, tomatoes, beans, Brussel's sprouts, choko, kohl-rabi, turnips, crimson clover, vetches, gooseberries, grapes, red raspberries, and strawberries. Plants which do best in slightly acid soils or are said to be very tolerant of that condition are beans, potatoes, sea kale, radish, water-melons, parsley, kumara, tomatoes, maize, black raspberry, blackberry, strawberry, cow peas, rye, oats, and lupins.

It will be noticed that some crops are listed under two headings. Such instances indicate the conclusions of different authorities. Where difficulties are being met in cropping it would be well to consider the position in the light of the above information. The very human tendency of rushing to extremes must be avoided ; it is so easy to believe that if a thing is good one cannot have too much of it. Overliming is generally unlikely to take place to any extent owing to the cost of the lime, but, to get the best results, the heavier dressing especially should be mixed well in the soil some time before sowing the crop. Crops which tolerate or prefer a slightly acid soil do not usually do so well on a very acid soil. Under such conditions a dressing of lime can be made with advantage and without neutralizing acidity altogether. This should be remembered in regard to the strawberry, tomato, and potato crops especially. In this regard it should be remembered that lime is used up, or leaches out, of soil fairly rapidly, and turning in green cover crops has the effect of increasing acidity, so that, even in the case where crops preferring a slightly acid soil are to be grown there is no reason why the practice of liming the soil and obtaining its valuable mechanical and chemical effects should be avoided so long as it is done with good judgment.

Vegetable Crops.

In warm districts short carrots and globe beet sown in early spring and autumn maintain a good supply of tender roots throughout the year; but in districts too cold for satisfactory autumn-sown crops of these vegetables for winter use, good sowings of a variety of intermediate carrot and long red beet should be made during the month of October. These will mature late in the season without becoming coarse. The planting of main crop potatoes should also be completed.

Towards the end of the month seed-beds should be sown down with savoy, red cabbage, and cauliflower; and, more especially in the colder districts, broccoli and kale. Out-sizes are not popular in vegetables of this kind; moderate-sized specimens of good flavour should be the aim. Such are planted closer than the larger kinds and so there is little, if any, loss in yield It is advisable to sow the seeds thinly; and to protect carefully the young plants from pests so that sturdy plants will be available for planting out in December and January on land from which early crops have been removed. Diamond-back moth will have the assistance of the white butterfly in many districts for the attack on this group of crops. The attack may be prevented most effectively in practice by dusting the young plants lightly in early morning or during the evening, when a light dew is on them, with 1 part of powdered arsenate of lead and 5 parts hydrated or air-slaked burnt lime thoroughly mixed In small gardens where a mechanical blower is not available, the powder may be placed in a wide-mouthed bottle with a fine-meshed cloth covering the mouth. The cloth should be loose enough to enable a cork to be inserted when the bottle is not in use, and tied round with galvanized wire. This treatment is recommended by the Assistant Entomologist at the Plant Research Station, Palmerston North, who has been experimenting with the different methods of preventing the serious damage that may be done by these insects.

In the warmer districts plants of marrow, cucumber, and melons, raised under glass, may usually be planted out towards the end of October in a light rich soil; or seeds, including pumpkins, may be sown in all districts where the conditions are suitable. It is important that a sunny well-sheltered position be chosen for these and other half-hardy crops. These include maize—sweet corn—which is rapidly winning popularity, and dwarf and tall beans for cooking green in the pod, or as flageolets (ripe and shelled), or as dried beans, thus supplying a variety of attractive dishes for the whole year round. The dwarfer varieties, such as Pale Dun, Feltham Prolific, and Stringless Green Pod, grown now on account of their relative immunity to wilt disease, should be sown a little thickly in rows 2 ft. apart.

A sowing of celery should be made now for the late crop, and of spinach and salads so that they will be well forward before the dry weather arrives. In dry districts New Zealand spinach should be sown now outside, or plants set out from boxes. It is of excellent colour when, cooked and of mild flavour, and provides a bountiful clean crop under conditions that would be disastrous to most other crops of the class. The only other crop of the kind for such conditions is what is known here as silver beet, plants of which may be set out now

Tomatoes, Egg Plants, and Peppers.

These half-hardy annual fruiting-plants require a warm sheltered position. As with most plants that are required to carry fruit almost immediately, they must not be grown too rankly; so nitrogenous manures must be used with discretion and overwatering and high temperatures avoided under glass. This does not mean an overcropped soil nearly destitute of humus is suitable for these crops, as too little nitrogen is as bad as too

much. Sufficient is required to grow a normal plant, and, when the fruit is set, more can then be given in solution if large-sized fruits are desired. Before planting, the nitrogen is best supplied in an organic form, such as farm manure, green crops, or blood manure, and, where heavy manurial dressings are the custom, a portion of the supplies of phosphoric acid also are best supplied in an organic form as bone or fish manure, with a proportion of soluble phosphates for the more immediate use of the plants in the form of superphosphate. Sulphate of potash also is applied—it stiffens the tissues and induces fruiting, and so is complementary to the action of the nitrates which alone or in excess produce soft, barren growth. It is for this reason that sulphate of potash is used rather liberally for such crops as these. In warm localities safe from the danger of late frosts the plants just considered may be set out towards the end of October ; elsewhere it is often the beginning or middle of November before this may be done satisfactorily. In preparation the manures should be turned under when ploughing or digging, and the fertilizers, two or three weeks before planting, should be worked in with the cultivator.

If sturdy plants that have never been checked in their growth are then set out, the average results should be satisfactory. Set the plants deeply and firmly, but they should not at all be tight round the collar Tomato plants outdoors are planted a foot apart with about three feet between the rows. They should be rather farther apart in the rows where the plants are trained to stakes, as in the more sheltered localities, and rather closer when the plants are trained on a wire trellis. Egg plants are set about two feet apart in the rows and peppers rather closer. It is advisable to make sure that the plants are well hardened off, and to set them out with as little disturbance of the roots or exposure to the air as possible.

The important functions which take place in the leaves of plants cause a great quantity of water vapour to be given off when active growth is taking place ; this means that in a confined space almost filled with growing foliage, as in the case of a tomato crop under glass at this season of the year, a very humid atmosphere is set up, which, while being very suitable for cucumbers and other crops, is most detrimental to the tomato crop, which requires a comparatively dry atmosphere. This can be obtained under the circumstances only by giving ample ventilation along the ridge of the house to allow the heated moist air to escape So long as weather permits, a little ventilation may now be given during the night, and this should be increased greatly early in the morning before temperatures rise unduly, taking care to avoid cold draughts. Instead of the foliage being thin and soft, and subject to leaf-mould, it will then be firm and stout and little subject to the attack of this fungus if the house has been properly cleaned immediately after the last harvest. As this disease causes serious loss annually, careful attention should be given to it, especially in warm humid districts. Watering is best done in the early morning.

Small Fruit Crops.

The harvesting of the choice berry crops commences with culinary gooseberries towards the end of October, followed by strawberries, raspberries, loganberries, and currants during the summer months. The perishable nature of some kinds of these fruits makes satisfactory distribution rather difficult. The old system of booking orders in advance for delivery in season is excellent under some circumstances, and might be used more with advantage to all parties.

Tree tomatoes (*Cyphomandra betacea*), passion-fruit, and Cape gooseberries may now be planted out in good land that is well sheltered from wind in warm localities.

The Homestead Garden.

Rose-trees, after pruning, sometimes make strong growth in undesirable positions : if such new growths are now removed the plants will be better

balanced and the well-spaced growth remaining will have a better chance of developing. Prune heaths, rhododendrons, brooms, acacis, and boronias after flowering ; it is usually sufficient to remove only the seed heads from rhododendrons. Use now a good weed-killer on the walks and drives. Harden off bedding-plants so that they will grow without a check when planted out. Complete the preparation of the ground in which they are to be planted by working in a dressing of fertilizers. Late October for warm districts and early November for the colder are early enough to plant out half-hardy annuals, dahlias, and chrysanthemums in well-prepared ground.

Handsome winter-flowering herbaceous plants are the hellebores ; they thrive in a rich moist soil that is rather shaded. They are suitable for the shrubbery or rock garden, and dislike being disturbed when once established. They may be planted out now. Following is an interesting note from a contemporary regarding the popular alpine *Gentiana acaulis*. To make these plants produce the large rich blue trumpets in abundance one should "after planting tread the soil as hard as possible and never hoe it." This advice from a grower in Great Britain who has unusually fine results should be tried to see if it suits local conditions.

—*W. C. Hyde, Horticulturist, Wellington.*

APPOINTMENT OF DIRECTOR, FIELDS DIVISION.

CONSEQUENT upon the retirement of Mr. J. W. Deem, Mr. R. B. Tennent, N.D.D., has been appointed Director of the Fields Division of the Department of Agriculture. Mr. Tennent had some experience in farming practice in Scotland before proceeding to Queensland, where he was a student in the Queensland Agricultural College for two and a half years and subsequently Manager of the Warren State Experimental Farm, Central Queensland, until his departure for active service. After the war Mr. Tennent gained the National Diploma in Dairying as a result of his studies at the West of Scotland Agricultural College, and then returned to Queensland before coming to New Zealand,

Mr. Tennent for a period held the position of Instructor in Agriculture to the Otago Education Board, which he left in 1920 to accept an appointment as Instructor in Agriculture in the Department of Agriculture. In this position his duties embraced work in Otago and Southland One of the major tasks that he was called upon to deal with related to the problems arising in respect to the extensive irrigation ventures in Central Otago; and in connection with this task, in 1923, on behalf of the Department of Agriculture, he investigated irrigation schemes in Australia, and again in 1925 he visited the United States of America, with an engineer of the Public Works Department, to study the bearing of irrigation in that country upon the irrigation projects in New Zealand. In 1933 he was appointed the Government representative upon the Taieri River Trust.

In 1928 he was appointed Fields Superintendent of the Department of Agriculture at Dunedin with supervision of the wide range of activities of the Fields Division in Otago and Southland. This position he occupied until his recent appointment as Director of the Fields Division.

Dairy Production in 1933–34.—The following information relative to the estimated dairy production in New Zealand in 1933–34 has been compiled by the Farm Economics Section, Department of Agriculture—the numbers in parentheses indicate the corresponding returns for the 1932–33 season : Total dairy cows in milk and dry, 1,932,511 (1,845,972) ; total dairy cows in milk only, 1,816,402 (1,723,913) ; total production in butterfat, 426,699,242 lb. (397,068,707 lb.) ; average annual production for all cows in milk and dry, 220·80 lb. (215·10 lb.) ; average annual production for cows in milk only, 234·91 lb. (230·33 lb.). The estimated average production per cow in 1933 is the highest yet recorded.

WEATHER RECORDS: AUGUST, 1934.

Dominion Meteorological Office.

THERE were two sharp cold snaps in August each associated with widespread snowfalls, the first shortly before the middle and the second before the end of the month. The second was the more severe, owing especially to the southerly gale which accompanied it. The remainder of the month, however, was mild and spring-like, and mean temperatures were, in general, somewhat above normal. A good deal of showery weather occurred, and the amount of sunshine experienced was less than usual. Rainfall was generally above average in the South Island, but below it in the North. Though, in some districts, there were heavy losses in the cold spell towards the end of the month, the lambing season is proceeding favourably. Pasture is plentiful for the time of year and stock are reported to be in very good condition. In Canterbury, the wetness of the soil has prevented the sowing of wheat crops over large areas, and the work on other crops is behindhand. Signs of spring in bird and plant life are numerous. White butterflies are already appearing in large numbers.

Rainfall.—As stated above, the month was a dry one over most of the North Island, eastern districts, from the Wairarapa to East Cape, particularly, receiving much less than the average fall. Parts of North Taranaki, the Bay of Plenty, and an area round Wellington, however, had rather more than the average; while in the extreme north there were some very heavy falls. In the South Island, most districts experienced a very wet month, but in Southland and the eastern portions of Otago and South Canterbury isolated areas recorded less than the average.

Temperature.—At a few places on the east coast the mean temperature was very slightly below normal, but over the rest of the country the normal was exceeded. The departures from the normal were generally slight. Frosts were fairly numerous and occasionally severe, but there were some beautifully mild days

Sunshine.—The amount of bright sunshine fell considerably below the average for August

Storm Systems—There were only three storms of any severity. A shallow depression which crossed the Dominion during the 5th and 6th caused considerable rain during its passage, especially in the far north and north-east. The disturbance rejuvenated, however, when it was to the eastward, and there was an outpouring of cold air from the south over New Zealand. Snow was widespread on the 9th, though it did not lie long at low levels. The weather became very cold, and severe frosts followed on the 10th and 11th.

A second depression, which had a considerable extension in a north to south direction, was responsible for northerly gales on the 15th and 16th and heavy rain fell in places. Snow was reported in places on the 17th after the depression had passed.

The worst weather in the month resulted from a cyclonic depression which moved in a south-easterly direction across the Dominion on the 22nd and 23rd. It was responsible for general rain with many heavy falls. After it passed, on the 24th and 25th a southerly gale extended over most of the country. Heavy snowfalls occurred on all the high levels, and in the interior of Canterbury it lay for several days on some of the plains. Frequent hailstorms were experienced at many places. Severe frosts followed until the 27th, but thereafter until the end of the month the weather was mainly beautifully fine and mild.

RAINFALLS FOR AUGUST, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.	Total for Year to Date.	Average for Year to Date.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	8·31	13	2·08	5·12	42·24	38·76
Russell	13·26	15	3·98	4·70	56·27	37·30
Whangarei	5·93	19	1·15	6·31	43·26	45·10
Auckland	2·95	15	0·81	4·21	35·73	31·26
Hamilton	2·85	12	0·49	4·11	30·72	33·11
Rotorua	4·54	13	1·18	4·91	36·64	36·76
Kawhia	2·64	16	0·33	4·63	33·25	36·18
New Plymouth ..	6·19	19	1·07	5·46	37·52	40·31
Riversdale, Inglewood ..	8·69	19	1·54	8·89	56·18	67·60
Whangamomona ..	6·28	12	1·20	6·02	43·94	48·99
Hawera	3·71	13	0·82	4·50	28·21	30·11
Tairua	6·95	16	1·41	5·84	40·69	45·71
Tauranga	7·50	15	1·90	4·20	40·96	35·95
Maraehako Station, Opotiki	5·68	11	1·96	5·49	33·29	37·73
Gisborne	2·61	11	1·57	4·33	20·09	34·29
Taupo	3·71	15	1·29	4·07	29·58	29·30
Napier	2·21	10	1·06	3·45	20·91	25·97
Hastings	1·89	10	0·56	3·13	17·77	23·42
Whakarara Station ..	2·05	7	0·62	..	33·78	..
Taihape	1·88	12	0·85	2·78	29·94	23·47
Masterton	4·49	13	1·20	3·61	24·95	26·64
Patea	3·52	15	0·68	3·81	27 62	29·44
Wanganui	2·76	14	0·65	2·81	23·80	23·85
Foxton	2·68	16	0·60	2·95	23·13	21·33
Wellington	5·15	20	1·39	3·82	32·07	28·82
			South Island.			
Westport	9·06	21	2·91	7·70	63·47	62·50
Greymouth	10·18	23	1·57	7·48	66·54	64·97
Hokitika	11·85	23	3·33	9·19	67·26	73·09
Ross	14·15	14	2·75	10·43	83·15	82·38
Arthur's Pass ..	24·50	12	4·15	10·20	109·73	96·07
Okuru, South Westland	15·72	15	2·73	11·24	..	93·80
Collingwood	17·27	17	3·61	7·11	67·96	62·09
Nelson	4·58	16	1·06	3·02	25·03	24·78
Spring Creek, Blenheim	3·74	12	0·60	2·75	20·42	20·64
Seddon	2·92	16	0·55	1·90	19·26	16·62
Hanmer Springs ..	4·08	14	1·05	3·41	38·53	29·39
Highfield, Waiau ..	3·53	10	0·98	2·45	26·80	22·53
Gore Bay	4·47	10	1·60	2·64	29·07	21·31
Christchurch	3·11	11	1·18	1·86	20·92	17·46
Timaru	1·00	10	0·27	1·47	18·68	14·43
Lambrook Station, Fairlie	1·87	11	0·48	1·53	20·45	16·13
Benmore Station, Clearburn	2·08	17	0·76	1·48	16·64	16·02
Oamaru	1·61	8	0·59	1·74	16·44	14·44
Queenstown	4·18	14	1·18	1·95	22·74	19·[illegible]5
Clyde	0·94	8	0·31	0·79	13·31	9·45
Dunedin	4·59	13	2·50	3·07	29·17	24·20
Wendon	1·99	9	0·41	2·05	20·53	19·27
Balclutha	2·55	11	0·95	1·78	24·54	16·27
Invercargill	2·45	15	0·55	3·22	28·91	29·67
Puysegur Point ..	7·52	21	1·11	6·94	48·54	55·35
Half-moon Bay ..	4·01	15	1·24	4·39	33·11	37·92

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HEDGES FOR MILD CLIMATE.

S. E. W., Te Puke :—

Please supply information about suitable hedges for this district. We get a fair amount of frost and some fairly heavy winds also, are situated about 1½ miles from the coast. I want a hedge for around the house and garden, say, about 4ft. to 6 ft. high, evergreen, and ornamental if possible.

The Horticulture Division :—

The selection of an evergreen and ornamental hedge for around the house and garden is very much a matter of taste. *Abelia floribunda* has the necessary qualities, but is perhaps hardly sufficiently vigorous for your conditions. *Cupressus Lawsoniana* planted 3 ft. apart on the weather side and *Escallonia exoniensis* planted alternately 1 ft. apart with *Tecoma Capensis* on the remaining boundaries would be both ornamental and evergreen. The weather in your locality is comparatively mild, so that it need not limit your selection of any of the hedge plants offered for sale

RAISING SEEDLINGS FOR SHELTER.

R. B., Heathcote Valley, Christchurch :—

Please advise me—(1) The best variety of pinus seed or macrocarpa seed suitable for a market-gardener to use as shelter-belts on a hillside, (2) right time to sow and the best method for sowing; (3) when the plants should be ready for planting into the permanent position after sowing the seed.

The Horticulture Division :—

The species of pine that is probably most suitable for the purpose is *Pinus muricata*; it is usually more compact and better furnished at the base than other species commonly planted. The pine and *Cupressus macrocarpa* seed should be sown in boxes or in wide drills outside during the month of October, and kept shaded until the seeds germinate Seedlings grown outside will require wrenching during moist autumn weather; wrenching is done by inserting a bright, sharp spade down each side of a row of plants in such a way that the roots are pruned of about one-third of their growth, and the soil tramped firm after the operation. Under good conditions the seedlings will be large enough for planting out during the following winter.

CROPS FOR PIGS IN NORTHERN DISTRICTS.

D. L. S., Cambridge :—

I desire information regarding the growing of soya bean or any other cereals that might be suitable for pig-feeding.

The Fields Division :—

Soya beans require for best results a climate suitable for maize-growing—*i.e.*, one free from frosts during full growing period. For several years soya beans were grown in the vicinity of Hamilton, but the yields were disappointing. Higher yields were obtained from ordinary Canadian Wonder garden beans, the cultivation and treatment of which is similar to that required for soya beans. Black skinless barley does fairly well on the undulating loamy soils of the Waikato, but is generally a failure on sandy pumice and peat flats. It is not known whether any cereal can be grown economically for pig-feeding in the Waikato and probably feeding for fattening on skim-milk, meat-meal, and grass and wintering sows on grass, roots, and meat-meal is the best practice.

CURING BACON.

P. W., Mangapehi:—

Please supply me with your recipe for baconing pigs.

The Live-stock Division:—

In brine curing all that is required is to pack the properly cooled meat into a clean barrel or trough and pour over this a prepared brine. For successful curing a cool damp cellar is best. Weigh out for every 100 lb. of meat, 8 lb. salt, 2 lb. sugar, and 2 oz. saltpetre. Dissolve all the ingredients in 4 gallons water and cover the meat with the brine. Make the brine a day before it is used. Bacon strips remain in from four to six weeks, and hams from five to eight weeks according to size. Any fermentation or ropiness can be checked by the addition of a small amount of baking-soda, by reboiling, or making a new brine.

DIFFICULT BREATHING IN PONY.

R. P. S., Opotiki:—

A pony mare that was very fat and running with other horses has developed a difficulty in her breathing, heaving heavily to get her breath even when standing still. She can eat, drink, and neigh. Since the trouble came on (four months ago) she has lost condition and looks as though she will die. Do you think she may have been kicked in the wind-pipe?

The Live-stock Division:—

Probably she is suffering from broken wind which clearly resembles asthma in the human subject. Give her about two tablespoonfuls of raw linseed-oil daily in her feed. There is no specific cure for this disease.

HOREHOUND ON SHEEP GRASSLAND.

G. D., Taihape:—

I have a patch of horehound on a steep face on my property, and am writing to ask you to let me know the best way to eradicate same. The patch has been there for some years and I have pulled it, but it is spreading. The face is too steep to get cattle on, and to-day the soil is very free and crumbling down, consequently no grass is left. If I use sodium chlorate would it be necessary to empty stock out of paddock?

The Fields Division:—

Like all other undesirable weeds in pasture, horehound indicates a weakening or opening-up of the sward, and suppression can be obtained only by strengthening or stimulating the pasture to such an extent that it will successfully compete with such weeds. To eradicate horehound, which has a woolly leaf, it would be preferable to dry-dust it with sodium chlorate rather than to spray. It would be advisable to mix thoroughly sodium chlorate, 1 part to 10 or 12 parts sand or carbonate of lime, and dust the horehound fairly heavily. There is no need to shift stock from the area. Next spring it would be well to sow broadcast with a mixture of—*Lotus major*, ½ lb.; browntop, 3 lb.; *Danthonia pilosa*, 6 lb.; crested dogstail, 4 lb.: total, 13½ lb. an acre. It would be advisable to apply superphosphate at the rate of 3 cwt. per acre, and drive a mob of sheep over the ground to thoroughly cover the seed and consolidate the ground.

PAMPAS GRASS AND TOETOE COMPARED.

W. T. B., Paengaroa:—

Is the pampas grass described in the May *Journal* the imported variety or our native kakahou?

The Chief Chemist:—

Pampas grass, although similar in growth form to the native toetoe (*Arundo conspicua*), for which another name is Kakaho, is an entirely distinct species, of taller growth, and having a denser flowering plume. The pampas grass has a leaf which can be easily broken, whereas the Kakaho has an extremely fibrous leaf difficult to break.

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INVESTIGATIONS REGARDING THE CONDITIONS DETERMINING THE QUALITY OF CHEESE.

RESULTS OF TRIALS AT RUKUHIA.

H. A. FOY, Dairy Instructor, Hamilton.

WHAT is known as the Rukuhia Experiment was the outcome of a request that the Dairy Division of the Department of Agriculture take control of a cheese-factory for a season in an endeavour to throw some light, if possible, on various factors affecting cheese quality.

The Rukuhia Factory, a branch factory of the New Zealand Co-operative Dairy Co., Ltd., was selected, and actual control of the manufacturing operations commenced on the 1st October, 1933. Prior to this there had been consultations with the suppliers, fifteen in number, and their co-operation solicited.

It was arranged that each farmer be supplied with a milk-cooler and also a "Hauraki" steam sterilizer, where such appliances were not already installed.

The Live-stock Division undertook a monthly examination of all cows supplying the factory for mammitis, and each supplier agreed to sample every cow in his herd, this being supplemented by can samples taken at the factory. A report from Mr. Kidd, Bacteriologist, shows the average percentage of infection from cow samples as 18 per cent. and from the can samples as 21 per cent., which is believed to compare fairly favourably with other groups tested in neighbouring districts.

The present manager, Mr. A. Laurent, in 1928 during his first season obtained results which could be classed as very fair. The next season he carried on much in the same manner, and for the greater part of the season had what may be termed a "good run," easily making close cheese of high-scoring quality, and he has often stated that, "no matter what he did, it was right." Since then, however, he has manufactured only a fair quality cheese, his main trouble being slit-openness.

EQUIPMENT AND MATERIAL.

Rukuhia is a typical four-vat branch factory, the plant and buildings being in very fair order. For the investigation a Berry Staybright starter heater and Dr. Moir's mother-culture outfit were made available. Both these units were of value to us in the care of our starters, there being no real cases of starter failures, and acidities were easily controlled.

The milk was graded daily, the curd and reductase tests being supplemented twice weekly by the Breed count method. Milk quality generally was quite good, but it is significant that, even in this group of fifteen suppliers, who were exercising special care, there were a number of instances where curd samples were second-grade on flavour, and from inspection of the milking plants it was quite evident that the greatest care was not being taken with the cleaning. A certain amount of this was due to lack of knowledge, and it is pleasing that where a supplier was advised no further trouble in this direction occurred. Curd-testing was operated by the Wilkins curd-testing machine, which proved very useful, being easy to operate and productive of a good curd. It was found that during the spring months relatively low cooking temperatures had to be used and the agitation time reduced, as with normal temperatures and times the curd at grading was much too hard and dry. During the autumn months some trouble was experienced with feed flavours and soft mushy bodies. This condition of body was not always easily accounted for, because there were several suppliers whose curds were quite normal, even although their feed was equally as dry as others and their percentage of mammitis milk as high. Neither the reductase, Breed count, or non-acid tests showed any of these milks as abnormal. A perusal of a soil-map of the farms in the district, compiled by the Department of Scientific and Industrial Research, does not permit of definite conclusions, although it is significant that curds from the milk of those farms consisting of larger proportions of Te Kowhai sandy loams were as a rule softer in body than others. This condition applied independently ot climatic conditions and of the quality of the milk from a sanitary viewpoint.

The temperature of the night milk delivered at the factory was generally below 65°,* but during the warmer weather it was found, in most cases, that this standard could not be reached. The highest temperature recorded was 70½°, but only on rare occasions was this encountered.

The most general type of cooler in use on the farms was the ripple chute, there being twelve of these, two jacketed pipe, and one Victory vertical tubular. All gave good results providing sufficient attention had been given to the water-supply.

The Hauraki steam sterilizers, on the whole, gave good results when used in the proper manner. The mere fact of placing a sterilizer in a milking-shed does not, however, make a careless person careful, nor an unclean one clean, and it was found on a few occasions that a little too much reliance was being placed on the sterilizer, rather than on the previous application of boiling water and soda. The result was that milk scale formed rather rapidly, and until this was removed and the normal system prior to sterilization reverted to trouble with the milk quality was experienced. There were two suppliers who did not use the sterilizers, relying on electric heaters for the water for cleansing, and as they were both naturally " good " suppliers no trouble was experienced with their milk. It is believed that both electric heaters were fitted with a " booster " element.

The average butterfat content of the milk during the period of our control was 4·24 per cent., which in the North Island is a medium fat

* Temperatures given throughout in Fahrenheit.

content. Each vat was tested daily for fat, and during the latter part of the season numerous casein tests were made. At times quite wide variations were noted, both from vat to vat and day to day, being, of course, widely affected by climatic changes. Several tests of all milks supplied were made for added water, and some suppliers were cautioned regarding a rather high percentage, presumably of rinsing water. It was found during the latter part of the season that a number of suppliers were not reducing their rinsing quantities in proportion to the lower amount of milk.

Practically all the milk was pasteurized, the regenerator being an ordinary two-dome Topliss. This machine was fairly satisfactory, although, owing possibly to the heavy material of which the outer dome is constructed, rather low regeneration, about 28°, was obtained. Pasteurizing temperatures were kept within fairly normal limits, ranging from 150° to 155°, the milk being, of course, well circulated both at commencement and finish of each run.

Water-supply and Drainage.—The water-supply at Kukuhia could be classed as fair, consisting of a well and a deep bore. Well water was good, but unfortunately formed only a small part of the total, especially during the autumn. The bore water, although plentiful, was of high mineral content, and not at all clear, having a distinct blue tinge and a strong odour upon standing for a day or so. Rusty deposits also soon formed in all pipes, &c., with which it came in contact.

All drainage was run into a concrete underground tank, from which it was pumped to a stream about a mile distant, the system proving satisfactory in operation.

Whey-tank.—This is constructed of wood, being cylindrical in shape and well kept. Piping to and from this tank is of ordinary galvanized iron, but as steam connections are fitted, both at the whey-pump in the factory and at the delivery pipe, it was possible to maintain a reasonably sanitary condition. No delivery hose is used, a system of loosely screwed 2 in. bends being quite effective and much more sanitary than either a rubber or leather hose.

Curing-room.—The curing-room at Rukuhia is very fair, having insulated walls and ceiling, and being separated from the making-room by a storeroom passage. Morganite thermostatically-controlled heaters are fitted, but unfortunately no provision is made for mechanical cooling. During the summer months a few high temperatures were recorded, but usually temperatures were slightly below the summer average for this district. The highest temperature was 74°, highest daily average 68½°, the highest relative humidity 95°, and the lowest 70°. Little trouble with mould-growth was experienced, this being kept in check by daily washing of the cheese-shelves, and frequent sulphur fumigation during periods of high humidity. No trouble was experienced with either damp or cracked rinds, and practically all cheese were coated with wax, the waxing-machine being installed in a small room adjacent to the curing-room.

Rennet, Colour, and Salt.—New Zealand rennet and colour were used exclusively, the rennet giving normal coagulation at 2½ oz. to 2¾ oz. per 1,000 lb. milk, whilst the amount of colour added varied from 1½ oz. to 3 oz. Even at the higher rate, it was often difficult to obtain the desired shade of colour, and in several reports, both from

the Auckland graders and the Department's officers at London, it was remarked that the colour was rather pale and indistinct. Glacia salt was used exclusively and proved quite satisfactory, and the storeroom was good.

Starter.—The starter milk was taken from the same supplier right through the experiment, this supplier being probably the most satisfactory one from a cleanliness viewpoint, and he also milked only "A" class cows for the starter supply. On vitality and non-acid tests, apart from the three grading tests, this milk was probably the best at the factory. The Berry heater proved very satisfactory in operation, apart from a little trouble with the dial thermometer, which required frequent checking. The maximum temperature was maintained for at least one hour, care being taken to avoid caramelization of the milk sugar. This machine is well insulated, and the milk was, as a rule, set at about 68° with 0·125 per cent. of culture, resulting in about 0·80 per cent. acidity the following morning. Heating temperatures in the mother-culture outfit were about the same as the main starter, but cultures were set lighter, a lower acidity being the general aim, and 0·80 per cent. being desired as the maximum figure at about six hours later than in the main starter.

Curd Knives.—The standard set of $\frac{3}{8}$ in. (22 blade) curd-knives as used previously in the factory was supplemented with a $\frac{5}{16}$ in. (24 blade) set, the finer cut, especially during the autumn months, giving much more satisfactory results.

MANUFACTURE.

October.—From the commencement, what may be termed normal manufacturing methods were adopted, with a view to ascertaining if methods used previously in the factory had been a contributing factor in relation to slit-openness. During the earlier part of the season, prior to taking control, some trouble had been experienced with sweet cheese, a portion having been second-graded for this defect.

The immediate aim was therefore along the lines of more acidity, but it is worthy of note that although we were "drying" the curds at 0·285 per cent. and 0·29 per cent., and obtaining anything from 1 per cent. to 1·11 per cent. of acidity at three hours from drying and 1·10 per cent. to 1·18 per cent. at three hours and a half, the first twelve days' make was considered by the Auckland graders to be a little on the sweet side. These cheese also showed, apart from slittiness, a certain amount of mechanical openness due possibly to the lack of acidity. A notable feature, however, was that by the time these cheese had reached the London market acidity had developed nicely, and, according to the London officers, were right for acid and body, and, apart from some mechanical openness, nice-quality cheese.

During the latter half of October acidity at drying was increased to 0·30 per cent., with an occasional 0·31 per cent., but with a slight decrease in acidity at three hours from drying. At grading these cheese appeared to be about right for acid, and were generally closer than previously, some being placed in the "finest" class. London reports on these cheese indicated that some were carrying quite enough acid, and the remainder about right.

The average factory test for October was 3·91 per cent., vat tests ranging from 3·8 per cent. to 4·3 per cent., and cooking temperatures 98° and 99°. At the commencement salt was applied at the rate of 2·7 lb. to 1,000 lb. milk, on a 4 per cent. fat basis, but was increased later to 3 lb., as the earlier cheese were considered a little light in salt. Generally speaking, good "shotty" cooks were obtained during the month, and little variation was made in methods of running and drying, whey being run at from 0·18 per cent. to 0·19 per cent. acidity, tap shut when a depth of 7 in. was reached, curds stirred in this amount for about seven minutes, tap opened full when desired acidity was reached, and remainder of whey drained from curd as rapidly as possible, with either two or three dry stirs. It was found that running off the vats in this way gave very uniform drying figures, it being possible to dry from day to day within 0·025 per cent. of the figure desired.

The starter used was one that had been operating in the factory previously, and so far as acidity, development, body, and flavour were concerned was quite satisfactory. Around 1 per cent. was used, with a ripening period after vats were filled of about fifteen to twenty minutes. Every vat was tested on acidimeter and by the Marschall rennet test as soon as filled and again before setting, the rate and amount of development being taken as the guide to setting rather than the initial figures. It may be mentioned that this method was in use throughout the season and served as a very useful guide relative to when vats should be set.

In the first month even with rigidly controlled manufacture slit-openness was evident, but was not quite so pronounced at the higher-drying acidities. However, it was later indicated that the cheese would not carry this higher acid satisfactorily, the limits of safety apparently having been reached.

Two other starters had been used for short periods during the month, but as they did not give satisfactory workings their use was not continued.

Vitality tests of starters were frequently made, and proved of great value in determining the acid-producing properties of each starter tried. As a rule, either three or four cultures were being carried, and tests were made at intervals of a week or less. The opinion is ventured that if more use were made of this test and "spare" cultures carried fewer cases would be reported of starter troubles and failures.

Milk quality during October was of a fairy high standard, second grade amounting to only 2 per cent., and this mostly in the early part of the month. Weather generally was cool, and, with the exception of one sample decolourizing in twenty minutes, milks "stood up" well above the two-hour standard on the reductase test. The remainder of the milk graded into second was for unsound flavour on the curd test, the cause of which was found to be insufficient care in the cleansing of the milking plants.

November.—During the first period of November acidity at drying was around 0·31 per cent. and 0·32 per cent., with 0·94 per cent. to 1·0 per cent. at three hours from drying, and an increase of about 0·05 per cent. at three hours and a half to three hours and three-quarters, when salt was usually applied. Most of these cheese were considered

to be right for acid at grading and some were " finest," but many showed a fair amount of slittiness. The same procedure was adopted during running off as in October, but a certain amount of chippiness became evident during cheddaring and after milling. This was not definitely accounted for, but was presumed to have been caused, in part at least, by high acid at running and drying. Cooks were good, but it was noticed that curds had a tendency to " come back " a little soft before milling.

However, curds that were chippy did not necessarily produce cheese that were more slitty than normal curds, nor did those that had " come back " soft. Following a reduction in acidity at drying to around 0·29 per cent., but with no corresponding reduction at three hours from drying, this chippiness became less evident, and curds were more pleasing to handle, but slittiness was not reduced.

November factory test averaged 4·09 per cent., vat tests ranging from 4 per cent. to 4·4 per cent., and salt was applied at the rate of 3 lb. for 4 per cent. milk, while cooking temperatures were 98° and 99°.

Three starters were used, one being made up from a Hansen powder culture at the factory, another obtained from Cardiff, Taranaki, and the other was a Wairarapa culture forwarded by Dr. Moir. All worked well, but the Wairarapa and Hansen were not used for long, both having unnatural flavours. The Cardiff starter was clean in flavour and continuously active, but slit-openness was present in cheese made from each starter to about the same extent

On the 21st and 22nd one vat was made from unpasteurized milk, and good curds resulted. At the time of making it was thought that a little more acid might improve the quality, but London reports indicated that these cheese were more normal in acid than most others at the time. Rather warmer weather was being experienced at this period, and as there were quite a number of samples on the curd test showing flavours no more unpasteurized cheese were made until early in December.

A summary of the month's work indicated that cheese made with three different starters were equally slitty. Dry, chippy curds did not appear to have any effect on slittiness, nor did curds which were both " acid full " and normal. Both vats made from unpasteurized milk were showing slit-openness at London, but not quite to the same extent as the pasteurized.

Milk quality showed some improvement over the previous month, there being only 0·9 per cent. second grade, all on the curd test. Although the weather was becoming milder, the great majority of samples " stood up " on the reductase test for four hours and over, only an occasional sample decolourizing around two hours.

November climatic conditions were quite favourable for milk-production, with a plentiful supply of green feed throughout the district.

December.—Early in December further experiments with unpasteurized cheese were carried out, and some trials made with equally divided milks—pasteurized and unpasteurized. The weather was fairly cool at this time, and good flavours were obtained. Drying acidity was around 0·29 per cent., which later proved to be ample. On the fourth day several loaf cheese were made from each vat and matured at the

factory. Upon being cut at five months, it was found that the unpasteurized was the superior cheese, having a nice clean cheesy flavour, whilst the pasteurized, although clean, was inclined to be a little neutral. Both cheese were fairly close, showing just a few small slits.

From the 5th to the 9th all unpasteurized-milk cheese were made, drying acidity being lowered to 0·27 per cent. on the 7th. At grading and at London, the 5th and 6th days' make were rather strong in flavour and acid full, whilst the 7th and 8th (lower acidity) were "finest" on both occasions. Unfortunately, the night of the 8th was very warm, with the result that flavours on the 9th were anything but pleasing, and the vats travelled rather too fast. This change was observed both at Auckland and London, it being worthy of note that, whereas the 8th day's make graded 93½ points, the 9th's was worth only 91½.

As there was such a marked difference in closeness between the 6th and 8th days' make it was arranged with Dr. Moir to make a full analysis of the two cheese. From the result of the analysis Dr. Moir found that the chief difference was in the salt to calcium ratio, which may have been a factor affecting closeness, but the limited experience does not justify definite conclusions.

From the tenth day pasteurization was reverted to, the spell of hot weather continuing to near Christmas. Practically the same drying acidities were observed during the remainder of the month, and for a period good results, with nice curds and smooth-bodied, close cheese, grading 93½ points, were obtained.

During the last period of the month, however, slit-openness again became evident in some cheese, but this could not be accounted for, because, to all appearances, curds that resulted in close cheese were no different from those that gave less satisfactory results. The Auckland graders consistently remarked on nice body and acid of both the close and slitty cheese, whilst London reports in these respect were also very favourable. Slittiness, however, was not so evident when these cheese were examined at Home as when the cheese were graded here in New Zealand.

Only two starters were used during the month, the Cardiff being replaced by Hansen No. 2, made at the factory. This starter was used from the sixth day, and it will be noted that, although all the "finest" cheese were made with it, some slitty cheese also resulted.

Unpasteurized-milk cheese was very satisfactory, but a notable feature was the effect of a warm change in the weather on both flavour and acid development.

Lower acidity at drying gave good results, but was apparently not entirely responsible for the disappearance of slittiness.

Besides the method of running vats off, as described previously, the "straight off" method was used for a part of the month, the procedure being to wait for the desired acidity at about two hours and three-quarters, then run the whey straight off at full tap, stirring curd in whey until vat was tipped, followed by either two or three dry stirs before piling.

During the warmer portion of the month a little trouble was encountered with faulty milk, the greater part of the 3 per cent. of second grade being in the earlier period. Warmer night temperatures also

showed their effect in the reductase test, several samples decolourizing in thirty and forty minutes, it being also generally noted that where a sample decolourized under one hour and a half an acidy condition on the curd test also followed.

Although some milks were delivered at temperatures of up to 70°, these were not necessarily the first to decolourize, indicating that other causes were operating. December average factory test was 4·16 per cent., with a range of 3·9 per cent. to 4·5 per cent. in individual vat tests, and salting was at the rate of 3 lb. for 4 per cent. milk with a 0·1 rise for each 0·1 per cent. increase in fat.

January.—January opened with cooler weather, and on the 1st all unpasteurized-milk cheese was made, but as most vats showed flavours pasteurizing was reverted to.

As rainfall at this time was below average, pastures were becoming a little dry, this being reflected in a falling milk-supply. Acidity at drying was around 0·26 per cent. to 0·27 per cent., with about 0·94 per cent. in three hours from drying, and showed normal acid at grading. Hansen No. 2 starter was still being used, and cheese graded 92½ points, slitty texture being the only defect. Several days' make in early January graded 93½ points, but, as treatment in the vats and curds was similar to that which resulted in slitty cheese, no definite reason could be given for the better results. Towards the middle of the month a change was made to a starter obtained from Dr. Moir, but these cheese were also slitty. A significant feature at this period was that, although this starter worked very similarly in acid development to the Hansen No. 2, cheese at fourteen days showed definitely less acid, and were not so "bright" in character.

Hansen No. 2 was reverted to, and the resultant cheese immediately showed improvement. This was a good illustration of "character" of starter, showing that although the other starter developed the same acidity the "nature" or "kind" of acid was different.

The cheese, although improved in character, were, however, too slitty to be placed in the "finest" class. Towards the end of January pastures were becoming fairly dry, with the result that good cooks were more difficult to obtain, and curds generally had a tendency towards mushiness or doughiness. Coagulation was normal, and cook up to a certain point was normal also, but the desired normal improvement at drying was becoming noticeably absent, with whey at drying inclined to be milky.

In an endeavour to effect an improvement, various modifications of the normal routine were tried. Firstly, acidity at drying was lowered to 0·25 per cent., curds at normal figures appearing to be carrying rather much acid, but no improvement resulted. Secondly, cooking temperatures were raised to 100° and 100½°, with the idea of expelling more moisture, this also without any appreciable effect. Higher drying acidities, up to 0·285 per cent., were then resorted to, with the idea that the high acid would have a tendency to expel moisture. These modifications were put into operation gradually, both with and without alterations in cooking temperatures, but it was found that better results were obtained with the normal routine. Additional stirring, both in the whey and on the pan, was also tried, but it was our experience that

curds were liable to be "fatty" and "ragged" without being any drier at three hours from piling. A little salt added to the curd after milling had the effect of removing most of the surplus whey, but it would have been much more pleasing to us to have been able to remove this whey during the earlier stages of manufacture.

Several laboratory casein tests indicated that the casein to fat ratio was below normal, but the impression was gained that other factors were operating against our obtaining normal results. Cheese made during this period were a little more satisfactory than anticipated, mostly grading 92 and 92½ points. Those at 92 points with 18 points for body were the lower dried, and had only about 0·85 per cent. acidity at three hours from piling.

At this period it was noticed that a number of samples on the curd test were soft in body and that such samples were not necessarily from those suppliers whose feed was the driest. Several samples were duplicated and starter added to one, and occasionally the curd with the starter added was much more mushy than the control, giving rise to the thought that some constituent forming the acid base was abnormally low in proportion. Several samples were subjected to the vitality test, but all showed normal acid development. The starter milk was fortunately giving a normal curd, and three starters, by the vitality test, proved normal.

The average factory test for January was 4·16 per cent., vat tests ranging from 4·1 per cent. to 4·5 per cent., and average rate of salting at three hours and a half to four hours was 3·1 lb. for 4 per cent. milk.

Besides Hansen No. 2 and Dr. Moir's starters, Cardiff No. 1 was also used for a short period, to note effect on curds, results being similar with each starter.

Methods of running off in January consisted of "straight off" run to 7 in., and also running whey down to 12 in. at two hours from setting, replacing agitators, and running off finally at approximately 0·02 per cent. higher than with the "straight off" method This method ensured good control of drying figures, but results were generally similar with each method.

Milk quality showed a falling off in January, and 5 per cent. was second grade. Feed flavours accounted for a portion of the increase, but defects in body were the most serious faults.

February.—Early February conditions were very similar to those of late January, whey being milky at drying, and about 0·3 per cent. salt was applied after milling. Acidity at drying was around 0·27 per cent., with about 0·90 per cent. to 0·96 per cent. at three hours. These cheese were carrying quite enough acid at grading, and were slitty in texture.

Another culture from Cardiff was received, and was used after about a week's propagation. This culture had been made up from a Hansen powder, and was giving very good results at the factory whence it originated. Our experience was, however, that very good results in the vats were not followed by a reduction in slittiness.

It was thought that in addition to the shortage of casein in the milk there might be some deficiency in minerals, and trials with the addition of these, which will be referred to later, were carried out. In the meantime a preliminary experiment, in which calcium chloride was

added in small quantities to one vat, was carried out, but no definite improvement was noted. The amount added was 0·025 per cent., but this was greatly increased in a later experiment.

About the middle of the month beneficial rain fell, and an almost immediate improvement in the condition of the curds was noted. This condition arose frequently during the autumn months, it being remarkable in view of the fact that the improvement often preceded any freshening of pastures. However, on this occasion the improvement was maintained to the end of the month, and, although openness did not entirely disappear, grades increased from as low as 91 to 92½ points, several lines at the latter score being awarded 19 points for body. A further Hansen powder (Hansen No. 3) had been propagated at the factory, and gave, apart from the slitty texture, good results.

The average factory test for February increased to 4·37 per cent., with a vat test range of 4·2 per cent. to 4·8 per cent., cooking temperatures being 99½° to 101°. Owing to the fact that mid-February cheese were showing plenty of acid at grading, the drying standard was reduced to 0·25 per cent., resulting in more pleasing acidities of the cheese.

Methods of running off consisted of the "straight off" and run to 12 in. at two hours methods, both, as previously, giving similar results.

As pastures generally were dry, supplementary feeding was resorted to by most suppliers, this consisting of turnips, lucerne, ensilage, maize, millet, &c., with the result that a number of vats showed feed flavours at grading. The milks responsible for these flavours were, however, easily determined on the curd test, and accounted for a fair proportion of the second grade awarded in milk-grading. Frequent casein testing indicated a low ratio of casein to fat, but this became practically normal after the rains.

In addition to the feed flavours referred to above, body defects in the earlier part of the month were responsible for a large portion of the 7 per cent. of second-grade milk received. Milk temperatures were satisfactory, practically all night milk being 65° or under. In the reductase test only five samples from a total of 420 taken decolourized under two hours, so that, according to this test alone, our February milk was of a high standard. From a cheesemaking viewpoint this was certainly not the case.

March.—Early March cheese were quite satisfactory, and were a little closer in texture, being awarded 18½ points for closeness, as against mostly 18 in February. Hansen No. 3 starter was still being used, curds being piled or dried at around 0·25 per cent. and 0·26 per cent. acidity. Curds generally were cooking well, but would not stand too much dry stirring, having a tendency towards raggedness. However, upon a change being made to a South Island starter obtained from Dr. Moir, a much brighter curd resulted, it being firm and smooth and breaking down nicely at three hours from drying. A feature of this starter was that although acid development in the whey was not very rapid, and the drying figure was no higher than previously, a higher figure at three hours was obtained, showing an increase of around 0·07 per cent. acidity. This had also been indicated in the vitality test. Although more pleasing curds resulted from the use of this starter, openness was

not reduced, and a starter that had been very successfully operated at Lepperton, Taranaki, was given a trial. Results for a period of about seven days were very pleasing, cheese grading 93½ points.

Unfortunately, however, dry weather conditions were again being experienced, with the result that the relationship between acid and cook was disturbed, and the grade fell to 92½ points, slitty and open texture being the defect.

During the latter part of the month a short trial had been made with a starter obtained indirectly from Opouriao, Bay of Plenty, where consistently close cheese were being made, but as this culture showed some contamination it was discarded.

Milk-supply at the end of March was declining rapidly, this being reflected in the higher butterfat content, the average test for the month being 4·63 per cent., with a range of 4·6 per cent. to 5·1 per cent. in vat tests. Casein tests indicated a low ratio during the drier portions of the month, and cooking temperatures ranged from 100° to 101½°, it being deemed inadvisable to exceed the higher figure. Results showed that cooks were no more pleasing at the higher temperatures than at the normal standard.

Milk quality showed some improvement in March, second grade being just under 4 per cent., practically all of which was by the curd test. Only four samples decolourized in less than two hours under the reductase test—three of these were second grade under the curd test.

April.—April was a dry month. As in part of March, difficulty was experienced in obtaining the type of curds desired, and a fairly large proportion of the samples on the curd test were showing the effects of the climatic conditions prevailing. Acidity at drying with the "straight off" method was around 0·26 per cent. and 0·27 per cent., which proved, with 0·85 per cent. at three hours, quite enough acid.

Early in the month another culture, direct from Opouriao, was used, and, apart from the slitty texture, gave good results. At this time an experiment consisting of holding some cheese from each vat for three days in the press was carried out with a vew to ascertaining if longer pressure would have a tendency towards reducing slitty texture. All the cheese from the vat were placed in the press as usual overnight, and next day three cheese, in the hoops, were removed to another press. Each succeeding day pressure was relaxed, the outside section of each hoop removed, lubricated, replaced, and pressure again applied. Results of this trial were disappointing, as the longer pressed cheese were as slitty as those held for the usual period.

A further experiment to test the effect of pressure upon the reduction of slittiness was the placing of cheese in Canadian-type boxes. Each box was made to fit a cheese fairly closely, and was similar in shape to an ordinary hat box, the height being so adjusted as to cause each cheese to project slightly above the side of the box. The cheese were placed in cool storage, stacked five high, and changed weekly, with the result that the cheese received almost continuous pressure. The value of this experiment will be ascertained at the end of three months storage.

An experiment with clarified milk was also carried out during the month, and will be referred to later.

Towards the end of April, when the lactation period was becoming well advanced, curds were rather greasy and "wintry" in character, with the result that lower acidities at drying had to be observed. Although slit-openness was noticeably less in the cheese at this period, bodies and general character were, as expected, not of a very high standard, and no cheese were placed "finest." During the last period of the month the whey was run to 12 in. at two hours and agitators replaced, this method, especially with a full vat containing about fourteen cheese, giving results that were more satisfactory than with the "straight off" method.

The average test for April was 5 per cent., and vat tests ranged from 4·8 to 5·7 per cent., with a general casein to fat ratio of around 0·47 to 0·51, the maximum cooking temperature being 101½°. Average salting was 3·15 lb. for 4 per cent. milk with a 0·1 rise in salt for each 0·1 per cent. fat increase. Throughout the season this standard was not rigidly adhered to, variations being made according to the character of the curd and other existing conditions.

April milk quality with 0·2 per cent. second grade was very fair, though quite a number of samples were just passable first grade for body, whilst only three samples from a total of 450 decolourized under two hours on the reductase test.

May.—As the milk-supply had very much diminished, control was relinquished on the 11th, when the factory ceased receiving milk daily. As in the latter part of April, curds were not very pleasing in character, cheese grading mostly 92 points, mechanical openness being more pronounced, whilst very little slittiness was evident.

During the last week of control a starter from Wyndham, South Island, forwarded by Dr. Moir, was used, but conditions were not such as to enable any definite opinion to be formed as to its value with relation to slit-openness.

Early in the month an additional trial in connection with longer pressing was made. In addition to the steps taken previously, the cheese were removed from the hoop completely and reversed end for end daily. It is worthy of note that each cheese so treated lost at least ½ in. in height whilst in the press for the three-day period, but examination of the cheese at grading did not indicate any marked reduction in openness. It is possible, however, that results may have been more satisfactory if normal cheese had been tried during the warmer weather.

Vat tests during the period ranged from 5·3 per cent. to 5·8 per cent., and casein to fat ratios were around 0·5. Weather was cold, with very little second-grade milk received, and practically all samples "stood up" on the reductase test for over seven hours. As in April, a number of samples on the curd test were passable first grade only for body, and the only second grades awarded were for this defect.

EXPERIMENTS.

Added Minerals.—During February a trial extending over fourteen days was made, in two 100-gallon vats, with the addition of various minerals. As it is to date not possible for research chemists to state

definitely in just what proportion the various mineral salts are present in normal milk, the experiment had to be more along the lines of a "shot in the dark" than would have been the case if there had been some definite basis to work on. The minerals used were magnesium chloride, calcium chloride, citric acid combined with sodium citrate, acid sodium phosphate, and sodium citrate combined with hydrochloric acid. All were added in varied amounts, with various acidities at drying, and strict controls were used. These cheese were examined at fifteen days, one month, and three months from date of manufacture. The control cheese in each case was either equal to or better than the cheese with the minerals added. This would apply both to body and texture, whilst in a few cases a slight chemical flavour was noticeable in the experimental cheese.

Clarification — With a view to ascertaining what effect the removal of mammitis pus cells, in part, would have upon cheese of quality, an experiment over a period of ten days was carried out in April. As it was not possible to obtain a proper clarifier, a 660-gallon Titan separator was used, separation being practically eliminated by means of several $\frac{1}{4}$ in. holes drilled in the top disk cover about 2 in. below the ordinary cream outlet, which was blocked. This machine served the purpose fairly well, though a small amount of separation did take place at the disk spindle. This was flushed out with a small quantity of hot water, the same amount being added directly to the control vat. The two 100-gallon vats were used, and special care was taken to have exactly the same milk in both vats. Examination of samples of clarified and unclarified milk showed, in every case, a marked reduction in pus cells and numbers of bacteria following clarification ; but, although it was noted on several days that the curd from the clarified milk was a little more pleasing than the control, no difference, either in body or texture, could be found either at fifteen days or six weeks from date of manufacture, all cheese showing a fair amount of slit-openness. All milk was pasteurized before being clarified, it not being convenient, with the facilities available, to clarify before pasteurization.

Heavy Cheese Bandage.—During December and January some trials were made with cheese bandages of different weights and strengths, to note the effect, if any, upon closeness. Four types, going by the numbers 25, 50, 60, and 70, apart from the ordinary bandage, were used, and none were waxed. Cheese in all of the heavy types settled down only very slightly as compared with those in the ordinary type, and several crates were held in storage for examination at maturity. An examination recently made indicated that the cheese in No. 25 were closer than the others, which were all similar in openness. It is intended to cut all cheese at an early date, when definite conclusions will be arrived at.

SUMMARY.

All cheese forwarded for grading to Auckland were tested for fat, moisture, and salt, an average of the results being—fat 36·36 per cent., moisture 34·11 per cent., other solids 29·52 per cent., fat in W.F.S. 55·18 per cent., salt 1·51 per cent., salt in brine 4·6027 per cent.

The average cheese grade was 92·232 points, with 11 per cent. "finest." No second-grade cheese was manufactured.

Milk-grading Tests.—From our experience at Rukuhia, comparisons made between the reductase and curd tests indicate quite definitely that the curd test is of infinitely greater value as a means of grading milk for cheesemaking than the reductase test. This does not necessarily mean a condemnation of the latter, which served quite a useful part in the determination of the quality of the milk received.

With regard to the comparative value of the rennet and titration tests as a guide to setting, the conclusion from the season's work is that, although both methods were of real help, the evidence would be in favour of the titration test, more especially for pasteurized milk. It is desired to emphasize the fact that the rate and amount of development must be taken as the guide in both tests, otherwise their value would be greatly diminished.

The experience at Rukuhia with unpasteurized milk for cheesemaking showed that, providing the milk was of very sound quality, very satisfactory results could be obtained, but that changes in climatic conditions had a very marked effect on cheese quality.

Starters.—It was found on several occasions when changing to a different starter that, although the same setting, drying, and three-hour acidities were obtained, resultant cheese at fourteen days were not similar in acidity or body. This was proved, by reverting for a day or so to the starter previously used, to be a characteristic feature of that starter, and not to other conditions. It was also noted that a change in starter would sometimes, even at same drying figure, cause the whey at drying to taste more acid, a significant feature being that these cheese would generally show a little more acid at grading. This confirms the opinion that type or "kind" of acidity varies largely between different starters.

Rainfall.—Lack of rainfall in the autumn months undoubtedly had a very large bearing on cheese quality, especially with regard to "body," but did not appear to cause any increase in slittiness as compared with the more favourable spring months. As the Hamilton rainfall from the 1st January to the 30th April totalled only 9·56 in., against a yearly average for that period of 14·09 in., it may be realized easily, especially with Rukuhia district's light soil, what effect there would be on milk-supply and cheese quality. Apart from Gisborne, with 8·78 in. of rain, Hamilton recorded the lowest rainfall for the North Island for this period.

Rainfall from October to April was also below average, being 5 in. less than in the previous season.

Home Reports.—Up to date of writing, reports from the Department's London officers, covering practically every vat to early January make, have been received, and in the main have been very satisfactory. A portion of October and November cheese was carrying quite enough acid, but, generally speaking, slit-openness does not appear to be quite so evident at the London end as was the case when the cheese were graded in New Zealand.

Taking the whole experiment generally, the greatest trouble encountered was slit-openness, and, apart from this, no difficulty in producing a sound commercial-quality cheese was experienced. Neither

sound manufacturing methods nor various modifications, as detailed previously, appeared to have any permanent diminishing effect on slittiness. None of the many starters, although active, and according to bacteriological examination comparatively pure, had the effect of producing consistently close cheese. In this connection it is worthy of note that in a number of instances where factories in neighbouring districts obtained cultures from Rukuhia, and adopted manufacturing methods very similar to our own, no trouble was experienced in obtaining cheese free from slittiness. A more concrete example was that during the season two Taranaki factories, one using the same starter as was in use at Rukuhia, were asked to carry out for a period their manufacturing operations on exactly the same lines as we had adopted, with the result that all cheese made by them under these conditions graded either 93½ or 94, the Rukuhia grade being 92½, with slitty texture.

A survey of the experiment leads to the conviction that some unknown factors had a marked bearing on slit-openness and other problems, and emphasizes the necessity for further research in an endeavour to throw more light upon milk and its constituents and products.

THANKS.

The writer's thanks are due to the following, and all others, whose willing help and co-operation were largely responsible for the smooth running of the experiment: The executive officers of the New Zealand Co-operative Dairy Co., Mr. W. H. Udy, Mr. A. Milne, Mr. A. Laurent and his factory staff, the Rukuhia suppliers, the Auckland grading and testing staff, Dr. Moir, Mr. C. Stevenson, Mr. Kidd ; and especially to Mr. A. McKenzie, whose advice and guidance were very much appreciated.

WAIMATE WEST DEMONSTRATION FARM.

REVIEW OF THE OPERATIONS, 1933–34 SEASON.

J. M. SMITH, Instructor in Agriculture, New Plymouth.

FOR the second year in succession we were favoured with wonderful weather conditions, and this has been a large factor in the very successful season that must be recorded. It will be remembered that the autumn of the 1931–32 season was one of outstandingly dry conditions, and as a result all reserves of fodder were depleted. The 1932–33 season was a good one from a weather point of view, and much leeway was made up. The season just concluded was, if anything, better than the 1932–33 season. The district in which the Waimate West Farm is situated is one where normally the spring is early and generally favourable. The summer and autumn, however, frequently give farmers cause for concern, as these seasons of the year are likely to be extremely dry. During the year just past the spring-like conditions prevailed right throughout the summer and autumn, with the result that pasture growth was good and the feed problems gave farmers no cause for concern. The general policy of increasing fodder reserves was continued, and a large carry-over

of hay and ensilage was made. With the increased stocking this season the probable carry-over of fodder will not be so great, but there is still sufficient to ensure the stock being well maintained should anything unforeseen occur.

The Objective.

A fact often lost sight of by the general farming public is that farms such as the Waimate West Farm are firstly farms for the carrying-out of experimental work and for demonstrating those methods and operations which experimental work has proved sound. This should be, and is, their first objective, but the fact is often lost sight of that to carry out this objective a sacrifice in financial returns may have to be made. As the farm has no endowments or financial vote, the matter of finance gives the committee much concern at times, for if no financial assistance is forthcoming the committee must consider ways and means of making the farm pay its way (as it has done this year), and consequently experimental work must suffer and the real objective of the farm is lost. It is with the knowledge that experimental work is costly that the Department of Agriculture gives an annual subsidy to the farm, but through force of circumstances this subsidy has been greatly reduced until it is not big enough to warrant the undertaking of any extensive experimental work. During the past few seasons much experimental work has been allowed to lapse and the committee has concentrated on the farm's finances, with the result that this season these are in a very healthy condition. There is no doubt that this farm could be run as a model up-to-date dairy-farm on sound commercial lines were this warranted, but to-day in Taranaki there are such farms in every district. What is really required is a farm giving the whole of its attention to various experiments which take one into the more or less unknown. To do this revenue must be assured. However, even in view of making revenue the first consideration, it has been found possible to carry along several standard experiments and to put down new trials.

Experimental Work.

As very little cropping is done, it follows naturally that the experiments are, in the main, in connection with pasture problems. Top-dressing naturally occupies a prominent position in pasture work, and in one field there is one series of plots top-dressed with various standard phosphatic manures. This trial is only in its second season, so that nothing very definite has yet been demonstrated, except that phosphatic manuring must be persevered with even in these times of stress. The pasture strips where no manure has been used in this paddock indicate a rapid reversion to an inferior sward. There are indications that potash may be deficient in these soils, and to determine this definitely two series of potash plots have been put down. In these potash is used alone and in conjunction with both lime and phosphate, while on one plot the whole three are in combination. This, by the way, is one of a series of some 150 plots being put down in Taranaki to determine the potash response belts in this province.

The matter of better strains of grasses and clovers is being given consideration. Already the great superiority of certified perennial rye has been demonstrated, while a series of clovers was sown down last spring.

It is recognized the world over that our New Zealand white clovers are the finest ones obtainable. Any English seed catalogue will recommend New Zealand white clover in the grass mixtures. Within our white clovers, however, we have strain variations practically as great as is the case in the ryes, and these strain differences will have just as great an effect on our production as did the rye-grasses. Although these plots have been down only a few months, the New Zealand No. 1 is showing up favourably against the others, which, by the way, include the famous Kentish Wild White.

The paspalum area promises to become well established. In its second year the paspalum was prominent in the autumn, and, given a dry autumn, it will probably come up to the expectations of its champions. This autumn being so spring-like, the rye-grasses continued to grow strongly right through the autumn, and consequently the paspalum did not show to advantage. The subterranean clover also gives much feed prior to and subsequent to the drier months.

The area sown with prairie grass did not come up to expectations. The strike was not good, and subsequent feedings had the effect of thinning out the stand still further. Notwithstanding this, in some of our older pastures there is much prairie grass, which gives a considerable amount of feed in the winter and early spring.

CROPPING.

As a rule very little cropping is done, but this season, in the preparation of a seed-bed for lucerne, some 4 acres were in crop. Two acres of rape were sown and grazed by the cows in the autumn, and it is interesting to record that no second-grade milk was delivered. The cows were given half an hour immediately after milking and then removed, and there is no doubt that with judicious feeding dangers of taint can be eliminated. Rape is a crop that is grown widely for cow-feed in some districts, and there seems to be no reason why it should not be included in our lists of autumn crops provided the feeding is carried out in a common-sense manner. The remaining 2 acres were in soft turnips, swedes, and chou moellier, all of which were fed out in the late summer and autumn without any trouble to either stock or milk. Half an acre of carrots and mangels for wintering the pigs gave a good crop.

In regard to cropping, the question arises as to whether it would not be a payable proposition to always have 4 acres or 5 acres of crop to carry an increased herd, but one of the factors militating against cropping at this farm is the weed problem. The early history of the farm reveals consistent grain-cropping with subsequent grazing abuse following self-sown pastures of doubtful quality, and wherever the plough is used weeds come up literally in millions, and these, particularly the fumitory, smother seedling plants.

HAY AND SILAGE.

Forty acres out of the 90 acres comprising the farm were cut for hay and ensilage, about equal proportions of each on an acreage basis being made. The concrete-tub silo was partly filled with grass instead of wholly with lucerne as previously. It will be recalled that previous seasons have resulted in much waste round the walls, and it was thought that perhaps with grass this waste might not occur. The waste, however, is practically as great as in previous years, and it is felt that the silo with thin walls will never be a success with long material. The quality of the hay saved this year was good.

LUCERNE.

The 4 acres which were resown are establishing satisfactorily, although the stands are not as good as those usually obtained after lea. The other 4 acres were cropped as indicated and will be resown with lucerne this spring. There is no doubt that in this district no dairy-farm should be without about 10 per cent. of lucerne on an acreage basis. With the chance of every season having a dry autumn, there is no finer insurance against drought than a good stand of lucerne. Even though grass encroachment may mean that the life of the stand may be only eight or ten years, even this period of useful lucerne will repay handsomely.

TOP-DRESSING.

The whole of the pasture land exclusive of that used for top-dressing trials has been top-dressed with 3 cwt. per acre of phosphate (super and basic super). On those farms where production is high no farmer can afford to neglect top-dressing, and the better the production the more important the top-dressing becomes. A farm producing 100 lb. of butterfat per acre might, without manure, drop by 20 lb. or 30 lb., but a farm producing 200 lb. of butterfat per acre might drop 80 lb. to 100 lb. without manure. While the seasonal conditions doubtless have been a big factor in the increased production, there is little doubt that the policy of continuing the standard rate of top-dressing has also had a bearing on it.

PASTURE HARROWING.

This work has been well maintained, and there is no doubt that at certain times of the year much harrowing is very desirable. If droppings are left undisturbed they do more harm than good to the pasture sward.

HERD.

The herd milked during the season was sixty-one in number, as against fifty-seven in the previous season. As usual, unfortunately, "empty" cows and "slips" were included in this total of sixty-one. The total butterfat for the season (factory returns) of 18,968 lb. creates a new record for the farm, the previous best being 16,639 lb. last season. On a cow and acreage basis this season's production worked out at 311 lb. per cow and 210 lb. per acre, as against 290 lb. per cow and 185 lb. per acre last season. The quantities of fat, in pounds, produced month by month for this season are as follows: July, 217·5; August, 1,268; September, 2,283·8; October,

2,625; November, 2,439·4; December, 2,192·2; January, 2,200·1; February, 1,747·9; March, 1,783·2; April, 1,336; May, 681·5; June, 194·1.

The total butterfat and the production per acre, in pounds, over the last five years are as follows:—

Year.	Total Fat.	Per Acre.
1929–30	13,458	149
1930–31	15,636	173
1931–32	15,982	177
1932–33	16,639	185
1933–34	18,968	210

Pigs.

During the past season these have been a profitable side-line. Five sows have been kept and the progeny sold either as weaners, porkers, or baconers according to the market and food-supply. Fifty-five pigs were disposed of, netting £79.

Stock-carrying.

A survey of the stock carried will indicate that this is fairly high, but given normal seasons and the usual carry-over of fodder-supplies the margin of safety is fairly good. Naturally a long period of adverse conditions would create a feed shortage, in which case some of the stock would have to be sacrificed; but with the chances of such a season being less than one in ten it would not be good farm practice to reduce the stock to a margin of safety to meet such exceptional conditions. The present stock carried on the 90 acres is as follows: 59 cows, 6 in-calf heifers, 14 yearling heifers, 2 bulls, 3 horses, 4 sows, and 1 boar.

Working-costs.

The statement of accounts and balance-sheet discloses a year of strict economy in every possible direction, and, considering the times, the result is highly satisfactory.

The Live-stock Account closes with a credit balance of £143 6s. 9d. Stock on hand at the beginning of the season was valued at £876 10s., while there were no purchases during the season. Stock on hand at the end of the year stand at £896, while sales of stock (pigs, calves, and cull cows) realized £124 6s. 9d.

A credit balance of £164 3s. 1d. in the Working Account indicates the attention that has been given to the farm expenditure. The total expenditure totals £588 11s., while milk sales produced £752 14s. 1d. The main items of expenditure are wages £272, manures £63, seeds and feed £10, rent £90, power £29, rates £25, testing £12, interest £69.

The Profit and Loss Account shows a credit balance of £212 14s. 11d. on the year's working, and this after allowing £110 16s. for depreciation on buildings and plant. General charges shown,

including secretary's salary, office expenses, printing and advertising, audit fees, insurance, depreciation, entertaining charges, and bank charges total £145 4s. 11d., while the Working Account credit (£164 3s. 1d.), the Stock Account credit (£143 16s. 9d.), and the Government subsidy (£50) leave £212 14s. 11d. to be transferred to the General Fund Account.

This report would not be complete without some reference to the splendid service given by the Manager (Mr. A. G. Paterson) and farm staff. In the face of wage-reductions and a policy of rigid economy in expenditure the farm has been kept in first-class order and the farm work faithfully carried out.

PASTURE TOP-DRESSING ON WEST COAST, SOUTH ISLAND, OF NEW ZEALAND.

EXPERIMENTAL WORK BY FIELDS DIVISION, PERIOD 1930–34.

R. McGILLIVRAY, Fields Superintendent, Christchurch, and J. STEVENSON, Fields Instructor, Greymouth.

THE West Coast Instruction District consists of Westland and that portion of Nelson contained within the Buller, Inangahua, and Murchison Counties. The total area of the district is 10,300 square miles. There are approximately 2,293 holdings in the district, and the average size of the holding is 554 acres. Grassland farming is the only type of agriculture of any moment there. Dairying, fat-cattle production, and sheep-farming are carried on, and where pastures have been improved the carrying-capacity and general production is satisfactory.

The climate of the West Coast is influenced by its position on the western side of the high dividing-range and the prevailing wind from a westerly direction. The rainfall is high, ranging from 80 in. to 100 in. per annum; but records show that the hours of sunshine experienced are high, and the district is noted for its clear atmosphere during fair weather periods. Much of the present farming land was at one time in bush and scrub. The greater part of the settlement is on river-flats and on areas of more or less open country such as the Wataroa, Harihari, and Totara Flat districts. Some top-dressing of pastures in the district was first undertaken by farmers many years ago. The Department of Agriculture laid down some trials about fourteen years ago, but it was not until 1930 that a systematic plan of top-dressing experiments in various parts of the district was inaugurated. In these experiments lime, superphosphate, potash, and nitrogen were used in the first series, but in the later trials nitrogen was omitted.

Considerable interest has been shown by farmers in the question of pasture management and the general utilization of the pasture growth. The making of ensilage is now a recognized farm practice, and the utilizing of the excess growth in this way has greatly improved pastures, and has given a clearer indication of the response received from suitable fertilizer applications. In the manurial survey of the district the plots were treated as follows: (1) carbonate of

lime, 1 ton per acre; (2) superphosphate, 3 cwt. per acre; (3) 30-per-cent. potash salts, 2 cwt. per acre; (4) sulphate of ammonia, 1 cwt. per acre. In the first series of plots the initial dressing of lime was not supplemented, but the later series of plots received an annual dressing at the rate of 5 cwt. per acre. Superphosphate and potash salts, after the initial dressings, were applied annually at the rate of 2 cwt. per acre. Sulphate of ammonia is not now used. Very few of the plots were fenced in, and were subjected to the ordinary grazing practice of the various farms on which they were laid down.

In reporting on any group of experiments some method must be adopted to indicate the nature of the effect of the lime or fertilizers applied, and thus the following points are awarded: 0, no visible response; ?, doubtful response; 1, slight response; 2, fair response; 3, good response; 4, very good response; 5, excellent response. In some cases responses to both lime and superphosphate individually may be classed as good (3 points each), and the response to the combined lime plus super may be excellent, and 5 points awarded. The points awarded for potash and nitrogen can be regarded for practical purposes as indicating their effects over and above those of lime plus super.

In Table 1 the responses to treatment, in the various classes mentioned, are presented as percentages of the total number of trials, while in Table 2 the responses in the individual trials are shown grouped in their respective districts.

Table 1.—Percentages of Total Number of Experiments which fall in various Response Classes so far as Response to the Main Treatments are concerned.

Treatments.	Degree of Response to Treatment.							Total Number of Experiments in which Treatment used.
	None visible (0).	Doubtful (?).	Slight (1).	Fair (2).	Good (3).	Very Good (4).	Excellent (5).	
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Lime ..	..	..	..	..	35·0	55·0	10·0	20
Super ..	..	..	25·0	65·0	10·0	..	..	20
Lime + super	..	..	..	..	..	30·0	70·0	20
Potash ..	80·0	5·0	5·0	10·0	..	..	..	20
Nitrogen ..	..	..	10·0	90·0	..	..	..	11

General Comments on Responses to Treatments (Table 1).

Lime.—All experiments gave from good to excellent responses to lime, and clearly indicated the great need for applications of lime to the soils of the West Coast district. In two cases the response was of a most outstanding nature and quite as good as the combination of lime and super. In most cases, however, lime and super applications were better than lime alone. The experiments have clearly demonstrated the value of this combination. The use of lime has increased the clover content of the pastures, caused a better and stronger growth of grass, marked improvements in the palatability of the pastures, and on several farms has caused a definite reduction of sweet vernal, rushes, and various weeds.

The dressing of 1 ton of lime per acre has given splendid results, but the addition of an application of a small quantity annually appears to be warranted. There are ample supplies of good limestone on the West Coast, and it is encouraging to see the use that farmers are now making of this commodity, which is essential to the welfare of the primary industries of the West Coast.

Superphosphate.—Most of the responses to superphosphate fall into the slight to fair class, and it can be said that top-dressing with super on unlimed land is not a practice that can be recommended on the West Coast.

Superphosphate plus Lime.—Results from this combination have been extremely satisfactory. The responses varied from very good to excellent. The results of farmers have been similar to the results obtained on the experimental areas, and one can state that the use of lime plus superphosphate has become the standard top-dressing practice of the West Coast districts.

Potash.—In all cases 30-per-cent. postash salts were used. In 80 per cent. of the experiments there was no visible response to the treatment. Two experiments showed a fair response in the way of a more vigorous clover growth and a darker-green colour in the pasture during the late summer and early autumn. On one experiment potash definitely suppressed clover growth, and in this case the grasses present were dry and neglected by stock.

Nitrogen.— The responses to sulphate of ammonia were all slight to fair. The responses were very brief, and in all cases the after-effect on the pastures was bad. There was a distinct depression of clovers, and the sward became open and inclined to run to brown-top, Yorkshire fog, and weeds. If the responses were measured for the whole season one would be justified in recording a "no response" in the case of nitrogen applications, but the responses indicated in Table 1 refer to results over a period of a few weeks only.

Table 2.—Showing Responses on Individual Farms to Treatments.*

Farmer's Name and Address.	Lime.	Super.	Lime plus Super.	Potash.	Nitrogen
L. Haddock, Harihari ..	4	2	5	0	2
G. Linklater, Waitaha ..	4	3	5	0	1
W. Rae, Arahura	3	2	4	0	2
Rothery and Maughan, Inchbonnie	4	2	5	0	2
W. Vallance, Rotomanu ..	3	2	4	0	2
A. Dalziel, Nelson Creek ..	3	2	4	?	2
P. Smith, Ahaura.. ..	4	2	5	2	2
W. O'Malley, Ikamatua ..	5	1	5	0	2
N. McVicar, Mawheraiti ..	4	2	5	0	2
J. Mitchell, Cronadon ..	5	1	5	0	2
W. Butterworth, Barrytown	4	2	5	0	..
R. J. Johnston, Maher's Creek	4	1	5	0	..
E. Cook, Kumara.. ..	3	2	4	2	..
J. C. Hende, Cameron's ..	4	2	5	0	..
J. Mul[illegible]re, Ngahere ..	3	3	4	1	..
Mrs. B. C[illegible]Leary, Totara Flat	4	2	5	0	..
Mrs. M. Cole, Murchison ..	4	1	5	0	..
M. E. Brown, Murchison ..	3	2	5	0	..
J. Westbrook, Longford ..	3	1	4	0	..
T. Joyce, Lake Station, Lake Rotoiti	4	2	5	0	..

* See introductory remarks for explanation of points.

Table 2 shows that the experiments reported upon cover a long stretch of country, extending from Harihari to Lake Rotoiti, near Tophouse, in the Nelson Province. The soils on which experiments were laid down embrace very light gravelly types, light to heavy loams, river silt, light beech terrace country, and mining "tailings." Manurial results, however, have not varied to any great extent, despite the great variation in the types of soil on which experiments were laid down. Liming and manurial trials were also laid down on the following farms: Dehn Bros., Wataroa, and J. Hart, Koiterangi, 1926; Leo Bell, Rotokohu, 1927; J. Butler, Matainui, 1929; A. McLennan, Waimaunga, and R. Gibbs, Maruia, 1930.

In these trials various fertilizers were used on limed and unlimed land. In all cases the value of lime application was demonstrated. On J. Hart's farm at Koiterangi, Nauru rock phosphate on the limed land showed a good response during the later stages of the trial, but during the first three years basic slag and superphosphate both gave much better results than Nauru. On A. McLennan's farm at Waimaunga, super and basic slag were both applied initially at the rate of 3 cwt. and 6 cwt. per acre, followed by annual dressings of 2 cwt. per acre. There was no appreciable advantage from the heavier initial dressings, but both superphosphate and basic slag gave results on the limed land. Basic slag, however, gave a better pasture covering, and there was a more varied mixture present in the sward. The trial on R. Gibbs's farm at Maruia showed a very decided lime response. The pasture mixture sown failed to establish on the unlimed portions, but the superphosphate plus lime plots showed quite a good pasture for the type of soil on which the area was established.

SUMMARY.

During the 1930-31 season fourteen L.P.K.N. experiments were laid down, but for various reasons four of these had to be discarded before any reliable results could be noted. Later, ten additional plots were laid down, using lime, super, and potash treatments.

The outstanding feature of all experiments has been the marked response to lime, and to super where used on limed land. The response to super alone does not justify its use in the West Coast district. There were very few responses to potash. There was a general but fleeting response to nitrogen in the plots where it was used.

The present series of experiments and the results obtained therefrom confirm the results of the earlier departmental experiments at Wataroa, Koiterangi, Waimaunga Experimental Farm, and elsewhere. All these earlier experiments demonstrated the value of lime and the unsatisfactory results from phosphates without lime. In these earlier experiments even basic slag and Nauru phosphate gave but meagre results in growth in the absence of lime, and were in some cases entirely neglected by stock, while the same phosphates on limed land gave good results and the plots were closely grazed.

The writers wish to acknowledge the assistance rendered by farmers in placing fields at the disposal of the Department for experimental purposes and generally assisting with the laying-down of plots. Thanks are also due to the various lime companies for supplying lime free of charge, and to the Farmers' Union and Agricultural and Pastoral Associations for general assistance and co-operation in connection with the experimental plots.

YOUNG FARMERS' CLUBS.

THEIR INAUGURATION AND EXPANSION IN THE OTAGO DISTRICT.

J. E. DAVIES, Instructor in Agriculture, Dunedin.

THE great value of agricultural clubs has been well demonstrated by the success achieved during recent years by the boys' and girls' agricultural clubs, which since their inception in the Otago District in 1919 have spread throughout the Dominion. The annual report for the 1932–33 season indicated that approximately three thousand boys and girls had participated in various sections of agricultural club projects consisting of crop-growing, calf-rearing, pig-feeding, and home-science competitions.

FIG. 1. MEMBERS OF THE PALMERSTON SOUTH YOUNG FARMERS' CLUB.

The agricultural clubs developed a strong competitive element, and the majority of the members were drawn from rural primary schools, the numbers continuing after school-leaving age being comparatively small. The boys' and girls' club movement attracted strong support from juniors, but its continuance in post-school education met with little support; every endeavour was made to establish a senior division of agricultural club work, but the venture attracted only a small membership, and its extension was therefore limited.

The valuable information and experience gained from the junior boys' and girls' agricultural clubs convinced the writer that there was a keen desire among young farmers for the establishment of an organization fostering post-school agricultural education, and the development of rural social life generally. It was with this object in view that Mr. R. B. Tennent, Fields Superintendent, Dunedin, and the writer in March, 1933, inaugurated a young farmers' club scheme, whereby

in country districts local clubs would be formed, bringing together a group of young farmers between the ages of fourteen and twenty-five. Clubs were established along the lines indicated by the following brief outline relative to the constitution and operation of clubs :—

The movement is to be known as "Young Farmers' Clubs." Members are to be from fourteen to twenty-five years of age. No member under the age of seventeen to be eligible for election to a controlling committee.

The object of the club is to promote agricultural education, leadership, thrift, perseverance, self-reliance, and co-operation with authorities in agricultural education.

It is suggested that during the winter months agricultural classes, lectures, debates, &c., be arranged, and for the summer months field days, demonstrations, and visits to the Agricultural and Pastoral Shows, model farms, experimental areas, &c., be organized.

In forming a club a general meeting of young farmers from the district is convened. At this meeting the executive officers of the club are elected. They consist of a chairman to preside at club meetings, a secretary to record minutes, attend to club correspondence, &c., a treasurer to keep club accounts, and also a general committee.

All club meetings are arranged and controlled by the executive. At these meetings lectures on agricultural subjects such as stock, crops, soil, &c., or any other subject pertaining to rural conditions are a prominent part of the activity.

A person exceeding the age-limit of club membership is appointed president. His duties are to attend club meetings and assist the young chairman in the guidance, control, and development of club work generally. Club meetings are held at least monthly, and a nominal fee is levied on members to cover running-expenses. A minimum of ten members is required to form a club.

The first club formed was at Palmerston South, and the initial meeting held in March proved distinctly successful. Following this, numerous requests for the formation of clubs were received and several others were formed. In January, 1934, successful clubs were operating at the following centres :—

Centre.	Date formed	Membership.	Number of Meetings held.	Lectures.	Debates.	Field Days	Demonstrations.
Palmerston ..	24/2/33	24	12	14	2	2	..
Five Forks ..	18/4/33	25	5	6	..	..	2
Dunback ..	19/6/33	12	4	3	..	1	..
Milton.. ..	4/7/33	13	3	3	1	..	..
Clinton ..	27/7/33	33	5	3	2	1	3
Paretai ..	18/10/33	17	3	3	..	..	..

At the above centres a definite syllabus of instruction was adopted —viz., a series of lectures on the "Establishment and Management of Grasslands." These lectures were conducted by officers of the Department of Agriculture, and, in addition, several supplementary lectures were given by other persons interested. The season's work culminated in a combined field-day and demonstrations.

Successful field-days, demonstrations, and programmes of winter lectures and debates, &c., have already illustrated the valuable work

which these clubs may be expected to accomplish. A properly constituted organization for the fullest development of the scheme has been established. A general meeting was convened at Dunedin in February, 1934. It was attended by representatives of existing district clubs, Department of Agriculture, Farmers' Union, and other allied organizations. At this meeting the New Zealand Federation of Young Farmers' Clubs (Incorporated) was constituted, following which a general council and provincial executives were elected. The personnel of the federation is: Grand Patron, His Excellency the Right Hon. Lord Bledisloe, P.C., G.C.M.G., K.B.E., D.Sc.; President, A. C. Cameron; Vice President, R. B. Tennent, Director, Fields Division, Department of Agriculture; General Secretary, S. D. Blomfield, Public Trust Buildings, Dunedin.

To the federation is given the responsibility of directing the movement on a national basis, and at time of writing marked

FIG. 2. PALMERSTON SOUTH YOUNG FARMERS' CLUB HOLD A STOCK DEMONSTRATION AT BUSHEY PARK.

progress has been made. Apart from several additional clubs being formed in the Otago District, provincial executives and clubs are now operating in both Southland and Canterbury and probably at the end of the present year a chain of clubs will be operating throughout the South Island.

In other countries the young farmers' club movement has reached considerable dimensions. The National Federation of Young Farmers' Clubs in Britain is now a movement of significance, and recent information reveals that in January, 1934, some 188 clubs were operating in England and Wales, and these has a membership of approximately four thousand boys and girls. The movement has also assumed importance in America, Canada, and Denmark, and it is anticipated that the movement will attain a similar degree of success and importance among the young farmers of this Dominion. The movement aims at becoming self-supporting; this, however, will take some time.

IMPORTATION OF FERTILIZERS IN 1933–34.

THE following particulars of the importation of fertilizers into New Zealand for the year ended 31st March, 1934, are compiled by the Inspector of Fertilizers, Chemistry Section, Department of Agriculture, Wellington, from returns furnished by courtesy of the Comptroller of Customs.

TABLE 1.—SUMMARY OF FERTILIZER IMPORTATIONS, 1933–34 AND 1932–33.

Fertilizer.	Quantity. Year 1933–34.	Year 1932–33
	Tons.	Tons
Bonedust and bone-char	..	30*
Basic slag	14,982	42,022
Seychelles soft phosphate†	22,618	10,032
Nauru and Ocean Islands phosphate ..	147,230	188,388
Island phosphate (other)‡	12,485	16,025
Egyptian phosphate	350	160
Phosphate (not otherwise specified)§ ..	5,437	6,024
Kainit	770	785
Muriate of potash	164	155
Sulphate of potash	618	682
Potash salts (other)	2,279	2,522
Sulphate of ammonia	2,813	6,840
Nitrate of soda	749	1,862
Cyanamide	..	5
Fertilizers unspecified	28	51
Totals	210,523	275,583

* Bone-char. † Includes phosphates from Seychelles Island and islands in the vicinity of Madagascar. ‡ Includes phosphate from Tuamotu Archipelago and New Caledonia (for details see Table 3). § Chiefly from Belgium—presumably North African phosphate ground in Belgium and re-exported.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1925–34.

Year ended 31st March,	Bonedust and Bone-char.	Basic Slag.	Super-phosphate.	Pacific and Indian Oceans Phosphate.	Egyptian Phosphate.	Moroccan Phosphate.	North African Phosphate (other)
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1925 ..	2,452	45,682	10	108,163	8,530	..	..
1926 ..	2,085	44,314	500	97,488	10,037	..	..
1927 ..	1,805	53,327	15	161,541	5,979	..	..
1928 ..	725	48,913	6,616	143,373	6,603	13,389	..
1929 ..	554	93,222	1,037	178,057	6,000	22,173	12,499
1930 ..	1,420	94,332	525	170,997	1,000	35,348	37,424
1931 ..	795	67,766	..	156,950	..	8,038	250
1932 ..	180	47,776	300	178,466	..	..	..
1933 ..	30	42,022	..	214,445	160	..	..
1934 ..	..	14,982	..	182,333	350	..	..

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL COMMERCIAL FERTILIZERS FOR YEAR 1933–34, SHOWING COUNTRIES OF ORIGIN AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Chile.	Pacific and Indian Oceans Islands.		Great Britain.			Canada.	Belgium.		France.		Germany.	Poland.	Netherlands.		Egypt.	Spain.
	Nitrate of Soda.	Source.	Raw Phosphate.	Basic Slag.	Sulphate of Ammonia.	Phosphate.	Sulphate of Ammonia.	Basic Slag.	Raw Phosphate.	Potash Fertilizers.	Basic Slag.	Potash Fertilizers.	Potash Fertilizers.	Potash Fertilizers.	Phosphate.	Phosphate.	Potash Fertilizers.
Auckland ..	454	Nauru/Ocean ..	76,235	4,651	1,150	5	200	1,132	3,275	615	..	760	110	..	400	..	200
		Tuamotu ..	4,907														
		Seychelles ..	10,337														
		New Caledonia..	2,286														
New Plymouth ..	105	Seychelles ..	1,251	3,510	..	..	..	3,464	1,052	155	..	170	75	..	..	..	100
		Nauru ..	10,363														
Wanganui ..	..	Nauru/Ocean ..	13,720	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		New Caledonia..	936														
		Tuamotu ..	2,115														
Napier	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..
Wellington ..	50	..	..	1,205	288	300	..	690	..	100	15	245	25	..	125	250	55
Nelson	..	..	..	..	250	..	..	25	..	20	..	105	..	..	..	..	..
Lyttelton ..	140	Nauru/Ocean ..	19,986	30	355	..	..	..	..	85	..	105	..	..	..	..	..
		New Caledonia..	555														
Timaru ..	..	New Caledonia ..	1,159	..	45	..	..	..	..	..	..	62	..	..	..	..	..
Dunedin ..	..	Nauru/Ocean ..	26,926	..	400	..	..	100	..	240	..	127	..	2	..	100	..
		Madagascar ..	3,658														
		New Caledonia..	527														
Invercargill ..	..	Seychelles ..	7,372	60	125	..	..	100	125	38	..	95	135	..	155	..	190
Totals ..	749	..	182,333	9,456	2,613	305	200	5,511	4,452	1,270	15	1,669	345	2	680	350	545

NOTE.—Additional items, not included in above table are as follows: Unenumerated fertilizers, 28 tons (Great Britain, Germany); and sulphate of iron, 6 tons (Australia).

CASTRATION, EARMARKING, AND DOCKING OF LAMBS.

W. T. COLLINS, District Superintendent, Live-stock Division, Auckland.

AT this time of the year a large number of lambs are being castrated, docked, and earmarked, and, although the operations are quite simple ones, many deaths are liable to occur unless the operations are carefully carried out and due care taken of the lambs during the time they are being handled and afterwards.

In the first place, the site on which the operations are carried out is an important matter and should receive due consideration. Old yards that have been in use for a number of years should be avoided as much as possible, as these are invariably contaminated with large numbers of organisms that set up blood-poisoning, &c., and the open wounds that result from the operations are liable to become infected and so lead to the death of the lambs. Even yards that may be looked upon as comparatively new and that have been in use only for a year or two should not be considered safe, as they are always liable to be infected, especially if they have been in fairly constant use. To avoid trouble it is far better to erect temporary yards in some clean part of the paddock. These are quite easy to erect; they necessitate only a few rolls of good strong wire netting, some stakes, and a few hurdles. The amount of material required and the size of the yards must, of course, be governed by the size of the flock that has to be handled. If a convenient and good clean site can be found near an existing wire fence, it will save much work, as the wire netting can be fastened to the posts. Actually only two yards are required—*i.e.*, one large one into which the ewes and lambs are mustered and a small one leading out of it into which they are driven to enable the lambs to be easily caught. It is always as well, however, to have a third yard in a handy position so that all the ewes that have not had lambs can be separated, and so give the ewes and their lambs more opportunity to make full use of the better pastures.

If the small yard is constructed of hurdles, a board approximately 6 in. wide on which the catcher places the lamb should be nailed on the top of one of them. This will be found very much more convenient than resting the lamb on a rail, and gives the catcher a very much better chance of presenting it in a good position to the person who is carrying out the operations.

On flat or low undulating country the erection of a temporary yard on a new site each year should present no difficulties, as the netting, stakes, and hurdles can be carted or sledged to the chosen site. On hilly country, however, this is not always practicable, nor is it always practicable to select a fresh site each year. Young lambs on hilly country are notoriously difficult to muster and to control when mustered, and it is only by careful and judicious handling that bad breaking-away can be avoided. There are nearly always certain ridges and gullies towards which the ewes and lambs run more freely, therefore sites on these places are selected each year for the temporary yards. However, the possibility of these places becoming infected and dangerous is very much less than where permanent

yards are employed, as the former are in use only once a year, and therefore have a good chance of becoming free of infection before the following season. It is not always possible to make the small catching-yard with hurdles on hilly country, but a suitable one can be made with the wire netting, using additional stakes to make it safe. An extra length of wire netting to run out a wing to lead the sheep into the yards will also be found to be very helpful.

CATCHING.

When the ewes and lambs are first mustered into the yards they are in a somewhat heated condition, and so it is advisable to give them time to become normal before operations commence. During this time the operator should attend to his knives, &c., and see that everything is in good working-order.

Once operations have commenced the work should go on steadily so as to get the lambs to their mothers as soon as possible. It is not necessary to draft the lambs from the ewes; in fact, this is not possible where temporary yards are used. Small drafts are driven into the catching-pens, and the fact that the ewes are still with the lambs makes it easier to handle the latter. The lambs should be caught and picked up carefully and carried over to the board on which they are to be placed for the operation. The hind legs should be drawn up between the fore legs and the lamb set on the board in front of the operator. Care should be taken not to draw the legs too far apart or too far back as this may result in injury to the joints or back. As soon as the various operations are completed the lamb should be carefully placed on its feet outside the catching-pen.

When the ewes and lambs are mustered for docking it is, as a rule, especially on hilly country, the first time the ewes have been yarded since crutching, so advantage can be taken of the opportunity of giving them any attention they require. The dry ewes should be picked out and penned ready for removal from the mob, and any ewes that require dagging or treatment for foot-rot should be attended to.

CASTRATION.

There are several methods of carrying out this operation—*e.g.*, drawing the testicles out, removing them by severing the cord with a knife or with a searing-iron, and the Burdizzo or bloodless method. Probably the most common is the first method mentioned.

There are two methods of exposing the testicle, one by cutting off the end of the scrotum or purse, and the other by splitting it. Each method has its own advocates. Probably the better method of the two is the former—*i.e.*, cutting off the end of the purse—as this allows for better drainage in the event of any infection taking place. This method also has a point in its favour as it shortens the scrotum and less wool is grown in a region that is more likely to become soiled. After the scrotum has been cut and the testicles exposed, they should be drawn one at a time, either with the teeth or with a special instrument made for the purpose. When drawing the testicles out the neck of the scrotum should be firmly grasped between the finger and thumb—this minimizes to a great extent any likelihood of injury to the inguinal region. Injuries in this region lead to hernia or possibly peritonitis, and death of the lamb.

Some operators, instead of drawing the testicle, remove it by severing the cord with a sharp knife. This method has an advantage over drawing, as there is not the same likelihood of the inguinal region being injured, but it has a disadvantage in that there is usually more loss of blood. Bleeding from an artery is arrested by the formation of a blood clot, and this takes place more rapidly after drawing the testicle, as the internal lining of the artery is more extensively damaged by this method than by cutting straight through with a sharp knife.

Removing the testicle by searing through the cord with a hot iron is advocated by some owners. This is a very much slower method than the ones mentioned above, but it has the advantage in that there is much less hæmorrhage following the operation.

The Burdizzo or bloodless castration has found favour with some farmers. The advantage in this method of castrating is that there is no open wound left through which infection may take place, and also no loss of blood. The disadvantage of the method, however, is that it is not possible, especially in young lambs, for the operator to be quite sure he has carried out the operation successfully. A special instrument is used, and the object aimed at is to crush the main artery leading to the testicle and so cut off the blood-supply. If properly carried out the testicle atrophies and disappears in the course of a few weeks. In many cases, however, the artery is not properly crushed and the blood-supply is not completely cut off, with the result that the testicle does not atrophy, although in many cases it does not develop as it normally should do.

In using the Burdizzo castrator care should be taken to see that only one cord is crushed at a time. If an attempt is made to crush both cords at one time, there is a risk of the blood-supply to the scrotum being cut off, and this may result in gangrene or death of the parts, followed by death of the lamb.

One of the reasons for failure to get good results with the Burdizzo castrator, especially in young lambs, is that the cord, being very thin, is not placed well within the jaws of the instrument and therefore is not crushed properly. Other reasons are that the instrument is applied too close to the testicle or even in some cases on to the testicle itself, with the result that the artery is not affected and the blood-supply not to any extent interfered with. In older lambs with more developed testicles the Burdizzo castrator may give good results if care is taken at the time it is used, but failures and the necessity for a second operation a few months afterwards are not unusual.

It is quite common to see lambs killed at the freezing-works with well-developed testicles in spite of the fact that they have been operated on by the Burdizzo castrator. If these lambs had been left till they were two-tooth or over, it is quite possible they would have been classed as rams or stags. Complaints have been received from freezing-works on this score.

Earmarking.

Under the Stock Act a brand means, in the case of sheep, a wool-mark, distinctly and plainly made with pitch, tar, paint, raddle, or lamp-black mixed with oil or tallow, in plain and distinct letters,

figures, or otherwise, not less than 3 in. in length, on the sides, back, shoulders, hips, or rump of the sheep, in conjunction with any one of the following marks, that is to say: (1) An earmark distinctly and plainly made by cutting, splitting, or punching the ear, but so that in no case shall more than one-fourth of the ear be removed; or (2) a metal clip affixed to the ear; or (3) a tattoo-mark distinctly and plainly imprinted on any part of the skin; or (4) a fire-mark distinctly and plainly made on the horn or face. Provided that the aforesaid wool-mark shall not form part of the brand in any district which is for the time being exempt from wool-marking.

A metal clip on the ear is seldom used in conjunction with a wool-mark to enable an owner to distinguish his own sheep from those of his neighbour, but is often used to identify particular animals in his flock, especially studs. The same remarks apply to the tattoo-mark, which is very useful in identifying particular animals, but if used in a general way the task of picking strangers out of a mob would entail a great deal of work, as each sheep would have to be caught and the ear examined. A fire-brand on the face has been used on occasions to identify particular sheep, but is seldom, if ever, employed now.

Some districts are exempt from wool-marking, and in these the metal clip, tattoo-mark, or fire-brand become the registered brand by which the owner identifies his sheep. Even in districts that are not exempt from wool-marking the method of marking cannot be looked upon as being satisfactory, as the growth of wool in a few months eliminates the possibilities of deciphering it.

It can be conceded that the majority of the owners rely upon the earmark to enable them to identify their own sheep, and, this being so, it is rather remarkable that more care is not taken in earmarking and all the animals marked as uniformly as possible.

The marking of the ears cannot be said to improve the appearance of any sheep, and if carried out in a haphazard, slipshod manner it will certainly detract from their appearance. One occasionally sees mobs of sheep advertised for sale about which it is stated they are "All one line" or "All one mark." In some of these the earmark has been put on very well and all the sheep are marked in a uniform manner, showing that some care has been taken at the time the earmarking was carried out, but in others, however, it is only by careful examination that one can satisfy oneself that all the sheep are carrying the same mark. If the earmark is to be a piece out of the bottom of the ear, it should be the aim of the person who is doing the earmarking to place this in the same part of each sheep's ear so that all look alike, and not, as is often seen, sometimes near the head and sometimes near the tip of the ear. The depth the mark is made in the ear is also very erratic in many cases. Sometimes the same mark is put well into the ear and at others it is very shallow and very easily leads to mistakes and disputes as to ownership. The same remarks apply to all earmarks no matter what size or design. The more uniform they are the better for identification purposes as well as for the appearance of the mob as a whole.

Docking.

The operation of cutting the tail off the lamb is usually carried out immediately before the animal is released. The cut should be made at about the second or third joint, and care should be taken to

leave the dock of uniform length. Before cutting the tail it is advisable to work the skin up towards the body so that when cut through it slips down and helps to cover the wound. If the skin is pulled down towards the end of the tail and then the cut made, the skin recedes, with the result that the bones are exposed and there is more chance of infection and delay in healing.

Some farmers use the searing-iron for taking off the tail, but it is doubtful whether it has any advantages over the knife. The searing-iron is always liable to injure the end of the dock, and, although there is less hæmorrhage, the wound may take longer to heal.

AGE FOR OPERATIONS.

The best age to castrate and dock lambs is when they are about three or four weeks old. To operate on them at this age is quite practicable where small flocks are being dealt with, but not practicable on high country where larger flocks have to be handled. On this kind of country the lambing often extends over a period of about two months, and when docking time comes round many of the lambs are over eight weeks old, whilst others are very young.

Although many lambs, especially the older ones and ones that are thriving very well, bleed rather freely after being operated on, it is not often that deaths occur through this alone. The lambs may get a slight check as a result of the amount of blood lost, but, if healthy and thriving, it does not appear to upset them much, for they soon recover. In the case of lambs in high condition, the loss of blood may even have a beneficial effect and leave the lamb less susceptible to pulpy kidney, a disease to which well-conditioned, plethoric lambs are subject. Lambs bred on poor country and not thriving well feel the effect of the operation and loss of blood, therefore it may be advisable to use the searing-iron in these cases.

"MOTHERING."

As soon as all operations have been completed and the ewes and lambs are out in the paddock again, it is very necessary to see that the lambs "mother" properly. The lambs at this time are far too young to fend for themselves. The very young ones will probably die if they do not find their mothers; the older ones may survive, but do not thrive, and by shearing-time are simply culls and no credit to the flock.

In small lots and small paddocks mis-mothering should not occur, but in high country lambs may have difficulty in finding their mothers. It is advisable to complete all operations early in the afternoon, so that mothering can take place before nightfall. To hasten this, the mob should be held in the vicinity of the yard and not allowed to wander too far, as there is always the likelihood of a ewe with twins returning to her feeding-ground with only one lamb and not troubling about the other.

Cleanliness is just as important in castrating and docking lambs as in all other operations. The operator should wash his hands carefully before commencing operations, and should wash them at frequent intervals while operations last. He should also have a bucket of disinfectant in a handy position into which his hands can be plunged.

The only instruments required are two knives, both of which should be kept clean and sharp and frequently placed in disinfectant. Some operators use one knife for both operations, but it is advisable to have two, using one for castrating and the other for docking, as the latter operation tends to make the knife blunt in spite of the fact that in lambs the bones of the tail are comparatively soft. When using the knife the operator should aim at making one clean cut. If more than one cut is made, ragged edges are left, and these considerably delay the process of healing.

Before the lambs are liberated the wounds should be swabbed or otherwise treated with some disinfectant; this not only minimizes the chances of infection, but tends to keep away flies that may be attracted by the blood.

As soon as operations have been finalized the tails should be counted to get a tally of lambs, and then they should be carefully collected and burned and not scattered about, as, if not burnt, they only create centres from which infection may take place.

A VIRUS DISEASE OF STRAWBERRIES IN NEW ZEALAND.

E. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North

THE successful cultivation of strawberries in this country has become increasingly difficult owing to the introduction of disease. In the Auckland District, strawberry-beds, which at one time yielded profitable crops over periods of three to four years, have now to be replanted every year. In the South Island, the beds are lifted every two years instead of every five to seven years as previously These changes in cultural practice have become necessary on account of the increasing prevalence of two degeneration diseases—a root-rot, and a disease which causes a stunting of the plants. The present paper is concerned only with the latter. This disease is widely spread, infected plants having been received from the Auckland, Poverty Bay, Nelson, Canterbury, and Otago districts.

A similar type of degeneration, causing a stunting of the plants, has, during the past ten to fifteen years, occurred in the strawberry-growing regions of Europe and North America. It has been attributed to nematode, insect, or mite injury (Ballard and Peren, 1923; Briton-Jones and Staniland, 1927; Massee, 1934) and to virus diseases (Plakidas, 1927; Harris, 1933). The variations in symptoms described suggest that several diseases are involved. Four of these have been proved by insect transmission or grafting experiments to belong to the virus group of diseases—viz., yellows or xanthosis (Plakidas, 1926, 1927), witches' broom (Zeller, 1927), crinkle (Zeller and Vaughan, 1932; Zeller, 1933; Vaughan, 1933), and yellow-edge (Harris, 1933). Of these four, xanthosis and yellow-edge appear to be very similar and the symptoms described for either agree closely with those of the New Zealand disease. Witches' broom and crinkle, however, appear to be quite distinct diseases, and their symptoms differ from those of xanthosis.

SYMPTOMS.

The first symptom of the disease is a yellowing of the young leaves which are smaller than the normal. As the petioles fail to lengthen these leaves become bunched around the crown The yellowing gradually becomes more pronounced especially at the leaf-margins. The older foliage is not visibly affected and remains for some time a striking contrast to the stunted younger growth (Fig. 1). The old leaves, however, tend to die prematurely and when they have fallen the infected plant is much stunted (Fig. 2) The flower trusses are smaller than the normal, the stalks are shortened, and any fruit which develops is small, distorted, and of little value. In the early stages the roots are healthy. As is common to all diseases of this type a plant once infected never recovers.

FIG 1. VIRUS-INFECTED STRAWBERRY PLANT

An early stage of the disease, showing small yellowed leaves together with normal leaves on the same plant

[Photo by H Drake]

CAUSE.

When in North America in 1929 the Mycologist visited several strawberry-growing districts on the Pacific Coast. The xanthosis of strawberries there so resembled stunted plants in New Zealand that on his return he suggested that the disease in this country might be due to a virus. This view was supported by the fact that field observations and cultural studies had failed to correlate the diseased condition with either mite or aphis infestation or with fungous or bacterial infection of the plants. An attempt was therefore made, both by insect transmission and by artificial inoculation, to determine whether the disease was of a virus nature.

INSECT TRANSMISSION.

Experimental Method.—Healthy plants were obtained by raising seedlings. Of the several hundred plants raised from seed in insect-proof houses at this Station not a single plant has shown any sign of disease. The healthy seedling plants were grown in 6 in. pots and wire frames then fitted to these. Muslin covers were drawn over the frames and tied so as to form insect-proof cages (Fig. 3). *Capitophorus fragariae* Theo.,* the aphis most commonly found on strawberries in this country, was collected from apparently healthy plants. Some of these aphides were transferred to virus-infected strawberry-plants and others to healthy seedlings. The aphides were left to breed on these plants. Leaves carrying aphides were removed from the infected or healthy plants and placed in the cages. The insects soon migrated from the leaves on to the healthy plants.

VIRUS DISEASE OF STRAWBERRIES.

On left: Plant exhibiting characteristic symptoms: small leaves and stunting. On right: Healthy plant. [*Photo by H. Drake.*]

For the first experiment, carried out during the 1931–32 season, there was no available glasshouse space so the caged plants were placed outside. The pots were let into the ground to prevent them from blowing over. Thirty plants were placed in three rows of ten plants per row. Two plants in each row were runners from Marguerite seedlings and the others were runners from Jersey Queen seedlings. On the 15th December, 1931, to each plant of one row 50–100 aphides from a virus-infected plant were added. The other two rows were left as controls, one being free from insects and the other having 50–100 aphides

* The identification of this aphis was kindly made by Mr. W. Cottier, Assistant Entomologist at this Station.

from a healthy plant added to each plant. At the end of twenty-three days all plants were removed to the glasshouse where the covers were removed and the plants fumigated After the covers had been replaced the plants were again placed outside. Six weeks later the plants were again taken to the glasshouse and fumigated. The covers and frames were removed and the plants placed in an insect-free house. At this stage no virus symptoms were present and almost two months elapsed before the plants were again examined. Four months after the insects had been added three of the ten plants which had been infested with aphides from a diseased plant showed definite symptoms of virus infection. All the ten plants of each of the control rows remained healthy

FIG 3 MUSLIN CAGES USED FOR INSECT TRANSMISSION OF THE STRAWBERRY VIRUS. *Photo by H Drake.*]

A second experiment was carried out during the winter of 1934, and this time the plants remained in an insect-proof glasshouse throughout the duration of the experiment. Twelve plants, all runners from one healthy seedling plant, were planted in 6 in. pots and covered with muslin cages as in the previous experiment. Four plants were left free of insects as controls. On the 1st May, 1934, to each of the remaining eight plants were added about twenty aphides which had been bred on a virus-infected plant. The aphides were allowed to remain on the plants for four weeks before they were fumigated. After fumigation the plants were placed, uncovered, in an insect-free glasshouse. Three months after the insects had been placed on the plants three of the eight plants were showing symptoms of the virus. All control plants remained healthy.

ARTIFICIAL INOCULATIONS.

An experiment, using sixteen seedling plants grown from Marguerite strawberry seed, was carried out on 27th May, 1933. Eight plants were inoculated by rubbing the leaves with muslin moistened with juice extracted from the leaves of a virus-infected plant. The eight control plants were treated in the same way with juice extracted from the leaves of a healthy seedling plant. The plants were kept in an insect-free glasshouse for three months and a half, but no sign of virus disease appeared on any of the plants.

METHOD OF SPREAD.

Strawberry virus is transmitted from the mother plant to the runners. The latter, although infected, do not immediately develop symptoms of the disease and may be set out as healthy plants. The introduction of such apparently healthy plants from nurseries is probably the chief manner of dissemination of the strawberry virus. Once the disease has been introduced, it is spread through the fruiting-beds by means of the strawberry aphis (*C. fragariae*), which is prevalent throughout New Zealand, on this plant.

REMEDIAL TREATMENT.

The only method of combating this disease is to produce disease-free plants in an isolated area removed from strawberry-growing localities. These plants could then be bulked to establish nursery-beds, producing in time the requirements of commercial growers.

Under ordinary commercial conditions the disease may be held in check by rogueing of infected plants. In nurseries a thorough examination of the plants should be made once a week and all infected plants removed. It is necessary to destroy both the mother plant and attached runners, since these runners afford the principal means by which the disease is spread. Rogueing of all diseased plants from the fruiting-beds will help to prevent the spread of the virus.

SUMMARY.

(1) A virus disease is one of the causes of degeneration of strawberries in New Zealand.

(2) The chief symptoms of the disease are: A marked stunting of the plant, the development of small leaves with short petioles and a yellowing of the foliage.

(3) The disease is spread by the strawberry aphis (*Capitophorus fragariae* Theo.).

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A SIMPLE METHOD FOR DETECTING "NON-ACID" MILK.

G. A Cox, Dairy Research Institute (N.Z.), Palmerston North

SLOW development of acid in the cheese-vat, due to the presence of "non-acid" milk, is a frequent cause of trouble in New Zealand cheese-factories. For the detection of such "non-acid" milk there is at present available to the factory-manager an application of the vitality test described by Whitehead and Cox.* The vitality test is used primarily for testing the vitality of a starter, but can also be applied to the detection of "non-acid" milk by using the same starter in samples of suspected milk. During the course of investigations at the Dairy Research Institute a new method, which is described in the present paper, has been worked out.

The method depends in principle upon the fact that "non-acid" organisms, when growing in milk, produce an inhibitory substance which holds up the growth of added starter organisms. If milk containing "non-acid" organisms is pasteurized, and starter organisms and methylene blue solution are added, the growth of the starter organisms is markedly retarded by this inhibitory substance. Hence the blue colour remains for a longer time than in a control milk which is similarly treated, but in which there are no "non-acid" organisms. The presence of the "non-acid" organisms is detected simply by the fact that the blue colour persists for a long time.

When a factory-manager experiences trouble due to the presence of "non-acid" milk in one of his vats the source of the trouble lies in all probability among those milk-supplies which contain large numbers of bacteria—*i.e.*, among the milks which have a methylene-blue reduction time of two hours or less. All such milk-supplies should be examined for the presence of "non-acid" organisms according to the method described below.

DETAILS OF THE METHOD.

A supply of test-tubes is needed, such as those used for the methylene-blue reductase test. These tubes should be numbered suitably. From each of the suspected milks a 20 c.c. sample is transferred direct from the weighing-vat to a test-tube by means of a dipper. A control sample is also taken from one of the best supplies. The

* Whitehead and Cox (1932): *N.Z. Jour. Sci. & Tech.*, 13, 304.

tubes of milk are pasteurized by immersion for ten to fifteen minutes in a bath of water the temperature of which has been raised previously to 145° F. (63° C.). Then, after the tubes have been cooled by immersion in cold water, three drops of a well-mixed starter from a vertically held pipette and 1 c.c. of ordinary methylene-blue solution are added to each. The tubes are inverted once (with finger over mouth of tube) to mix the contents, and are incubated in a bath at 98° F. (37° C.). An occasional examination is made to find the time taken for the blue colour to disappear. With a normal starter the colour in the control sample should disappear in about two hours and a half. If "non-acid" organisms have been present in sufficient numbers before pasteurization in any of the samples, the colour in such tubes will persist for several hours longer than in the control. Sometimes the colour in a tube may remain only an hour or two longer than in the control. This indicates a border-line case. Such a milk would probably not cause any slowness in the vat, especially if mixed with a reasonable quantity of normal milk, but it is a potential source of trouble, and may be worse on some days than on others. Where there is actual trouble in the vat, however, at least one sample will be found in which the blue persists for several hours longer than in the control.

Summary of Method.

Measure 20 c.c. of various milks into test-tubes.

Pasteurize by immersion of tubes in water at 145° F. for ten to fifteen minutes.

Cool the tubes in cold water.

Add three drops starter and 1 c.c. methylene-blue solution to each tube.

Incubate tubes at 98° F., and note time taken for blue colour to disappear.

Precautions.

(1) The tubes should be clean, but they do not need to be sterilized.

(2) The dipper used for transferring milk to the tubes should be washed each time before use.

(3) The starter should be well mixed by pouring from one vessel to another several times.

(4) The finger used for clothing the mouth of the tube when mixing the contents should be wiped, so as to avoid mixture of one milk with another.

Experiment showing Sensitiveness of the Method.

In order to find the sensitiveness of the method for detecting "non-acid" organisms, the following experiment was carried out in the laboratory.

Raw whole milk was collected at the Massey Agricultural College milking-shed late in the afternoon, and was distributed in flasks. These flasks were then inoculated with various amounts of a known "non-acid" culture, and were incubated overnight at 68° F. (20° C.). A flask of milk to which there was no addition was also incubated as a control. Next morning tests were carried out on the various samples. These samples would correspond more or less with various uncooled evening milks delivered at a factory the next morning by farmers.

The results of these tests are shown in the following table :—

Test No.	I. Number of Organisms per Cubic Centimetre	II. Reductase Test on Raw Milks : Time for Decolourization.	III. Vitality Test.			IV. Methylene-blue "Non-acid" Test : Time for Decolourization.
			5½ Hr.	6½ Hr.	Rise.	
1 ..	204,000,000	¼ hour.	1·5	1·4	−0·1	>6¼ hours
2 ..	127,000,000	½ hour.	1·3	1·2	−0·1	>6¼ hours.
3 ..	117,000,000	½ hour.	1·4	1·4	0·0	>6¼ hours.
4 ..	116,000,000	¾ hour.	1·7	2·3	0·6	>6¼ hours.
5 ..	94,000,000	1½ hours.	1·9	3·3	1·4	>6¼ hours.
6 ..	56,000,000	2 hours.	2·4	4·8	2·4	3¾ hours.
7 ..	40,000,000	..	2·7	5·1	2·4	2¼ hours.
Control ..	8,000,000	3¼ hours	2·9	4·8	1·9	2¼ hours.

In column I are shown the bacterial counts on the raw milks in numbers of organisms per cubic centimetre, as done by Breed's method.

In column II are shown the reductase times for the raw milks. The shortest times for the reduction of methylene-blue indicate the most highly contaminated milks.

It is important to bear in mind the distinction between the *reductase test* and the *methylene-blue " non-acid " test."* In the reductase test methylene-blue is added to the raw milk, and the time for decolourization at 98° F. is noted. In the methylene-blue " non-acid " test the samples of milk are first pasteurized. Then starter and methylene-blue are added, and the time for decolourization at 98° F. is noted. The *reductase test* is used for finding the bacterial quality of the milk. The *methylene-blue " non-acid " test* is used for detecting whether " non-acid " organisms have been present in appreciable numbers.

In column III are shown the results for the detection of "non-acid" milk by the application of the vitality test. These tests were carried out as follows: 150 c.c. of the various milks were pasteurized in bottles at 145° F. (63° C.) for half an hour, and were then cooled to 86° F. (30° C.). Each was inoculated with 1·5 c.c of the same starter, and the tests were further carried out in the usual manner for vitality tests. Titrations on the whey at five hours and a half and six hours and a half are recorded. Where has been a high contamination by " non-acid " organisms, the rise in acidity is nil. A smaller contamination by " non-acid " organisms has restrained the acid production somewhat.

In column IV are shown the results for the methylene-blue " non-acid " test carried out as described in this paper. Samples which had contained a large number of " non-acid " organisms before pasteurization retained the blue colour for over six hours and a quarter. In one test the blue colour disappeared in three hours and three-quarters. Evidently the smaller number of " non-acid " organisms present in this sample was such that the inhibitory substance produced restrained the growth of added starter organisms only a little.

The results given in the table show that the methylene-blue " non-acid " test is somewhat more sensitive than the vitality test for detecting " non-acid " milk. Samples giving a small rise in acidity by the

vitality test showed up by the methylene-blue "non-acid" test as most distinctly "non-acid." A sample giving a normal rise in acidity by the vitality test was shown to give a fairly definite indication of being "non-acid" by the new method. Thus the new test would pick out "non-acid" milk in certain cases where the application of the vitality test would fail to do so, and hence would give a warning as to those samples which, although not at the moment causing trouble in the vat, might possibly do so on some occasions.

SUMMARY.

A simple test for detecting "non-acid" milk has been described. This test is suitable for use by factory-managers experiencing trouble with slow vats, and wishing to find the cause of the trouble. The test should be applied to those milk-supplies which usually have a reductase time of two hours or less, as the cause of trouble is most likely to occur amongst the most highly contaminated milks, although a milk which has a reductase time of over two hours may on occasion show the presence of "non-acid" organisms by the test. From the figures quoted it is evident that a milk which is capable of causing "non-acid" trouble must necessarily have a fairly high bacterial count. The new method has the advantage over the vitality test n that it is somewhat more sensitive and is simpler in operation.

The author's thanks are due to Dr. H. R. Whitehead for his advice and criticism.

FARM SEEDS.

N. R. FOY, Seed Analyst, Department of Agriculture, Palmerston North.

GERMINATION OF 1934 CERTIFIED PERENNIAL RYE-GRASS.

THE appended table indicates the average germination capacity of samples of certified perennial rye-grass officially drawn from January to May, 1934.

Production District.	Number of Samples.	Germination Capacity.		
		Maximum.	Minimum.	Average.
		Per Cent.	Per Cent.	Per Cent.
Hawke's Bay ..	224	99	50	94
Poverty Bay	125	99	60	94
Manawatu	61	97	34	89
Wairarapa	10	98	83	93
Wanganui	3	86	75	80
Marlborough	2	98	96	97
North Canterbury ..	32	97	52	89
Mid-Canterbury ..	6	98	86	92
South Canterbury ..	21	95	30	65
North Otago	13	96	41	58
Central Otago ..	37	99	62	94
Otago	2	83	86	80
Southland	14	94	12	52

AUSTRALIAN REGULATION REGARDING COCKSFOOT IMPORTS.

By a Proclamation gazetted on the 17th May, 1934, the Federal Government prohibited the importation into the Commonwealth of Australia of cocksfoot (*Dactylis glomerata*) seed unless satisfactory evidence is produced that the seed is of a highly persistent strain grown under Government supervision in the country of origin, or, alternatively, unless the seed is coloured by thoroughly mixing the total bulk of the seed with one-half of 1 per cent. of fine polishing rouge until the colour is uniformly distributed on the seed.

SEED-TRADE STATISTICS.

The table below indicates the imports and exports (in hundredweights) of the main farm seeds for the quarter ending March, 1934 :—

Seed.	Exports.			Imports.
	Certified.	Uncertified.	Total.	
Alsike	..	..	1	604
Red clover	..	..	509	289
White clover	41	100	150	51
Other clover	..	..	114	443
Brown-top	135	74	209	..
Chewing's fescue	..	..	2,306	..
Crested dogstail	..	..	193	..
Cocksfoot	356	341	697	889
Lucerne	..	..	*	Nil
Paspalum	..	..	..	1,021
Poa pratensis	..	..	..	4
Perennial rye-grass	814	6,076	6,890	Nil
Rye-grass, Italian, &c	..	..	5,745	Nil
Timothy	..	..	..	472
Other grass	..	..	779	211
Rape and kale	..	..	..	30
Turnip and swede	..	..	..	6
Total	1,346	6,600	17,593	4,020

*Included with other grass.

SEED-STAINING.

The Seeds Importation Act, 1927, requires that before certain seed is permitted entry into the Dominion a proportion of such seed must be stained red. The seeds at present covered by the provisions of the Act are—White clover, 10 per cent.; lucerne, 10 per cent.; and cocksfoot, 1 per cent. Seed-staining is enforced in many countries throughout the world, the objective being in the majority of cases the protection of home-grown strains by the prevention of substitution and adulteration with seed of inferior plant types. In some countries different colours are used to distinguish between seed imported from different parts of the world, so that buyers may select according to their requirements.

VITALITY OF SEEDS.

Loss of vitality in seeds is caused by a decline of energy following chemical changes in the materials stored within the seed and by pathological influences—bacteria and fungi. Vitality as measured by

the energy of growth decreases more quickly than the viability or capacity to germinate. The normal decline of vitality is accelerated by unfavourable conditions such as high humidity, which causes increased respiration and in consequence a greater loss of energy. The continuance of such losses will result in a stage being reached when the seed still retains the capacity to "germinate" but lacks sufficient energy to produce normal roots to enable it to establish an independent existence. In seed-testing practice these abortive seedlings are discarded as dead seeds.

In trials conducted over a number of seasons the use of a mixture of superphosphate and carbonate of lime appeared to provide the best means of overcoming serious germination injury likely to result from the use of superphosphate alone. Trials at the Plant Research Station with carbonate of lime from twenty different sources, however, have shown that there is considerable variation in the effectiveness of the different limestones in correcting injury caused by superphosphate. The cause of such variation and a possible remedy in the case of the more unsatisfactory lines of carbonate of lime is under investigation.

Large numbers of calves are still lost or their constitution impaired as the result of pulmonary and intestinal parasites. In the prevention and treatment of these parasites, management and feeding play a more important part than drugs Supplementary feeding is the sheet anchor in combating the effects of parasites in young cattle, and without this any line of medicinal treatment cannot be expected to give the best results —*Report, Director of Live-stock Division.*

SEED CERTIFICATION CHARGES.

THE following scale of charges will be inaugurated in the 1934–35 season :—

FIELD CHARGES.

GENERAL CONDITIONS.

1. Field charges are computed on an acreage basis, but certain minimum fees are payable in respect to each crop entered by any one grower, and additional fees are payable in respect to late entries.

2. Closing dates are determined for each crop in each district, information on which may be obtained from the local Instructor in Agriculture. Applications not received on or before the closing dates will be regarded as late entries and must be accompanied by a late entry fee. Late entries will be accepted and regarded as eligible only provided the Department agrees to perform the services required.

3. All field charges are payable by the grower and whenever a fee is due certification services will not be undertaken by the Department on behalf of that grower until such fee is paid.

4. The field charges, including the minimum fee and late entry fee, for any crop cover all entries of that crop made by any one grower on the one farm. The acreage for the purposes of charging is taken as the total acreage of any one crop entered by one grower on one farm, irrespective of whether this is in one or more paddocks.

5. (*a*) If a grower enters more than one kind of seed for certification, then on each kind the charges will be computed separately except as in 5 (*b*).

(*b*) In the case of two kinds of seed being harvested together—*e.g.*, white clover (eligible for certification) separated from certified rye-grass at threshing time—the field charges on the one kind of seed also cover the second kind, but machine-dressing fees on both kinds will be payable.

SPECIFIC FIELD CHARGES.

6. *Rye-grass, Cocksfoot, and Clover.*—(*a*) The charge will be at the rate of 1s. per acre or part thereof with a minimum charge of 10s. The total fees must accompany the grower's application.

(*b*) An additional late entry fee of 10s. must be paid by each grower in respect to each crop for which applications are received after the closing date. This fee must accompany the grower's application and in no case will it be refunded except as provided in 6 (*c*).

(*c*) Should an application for certification be ineligible or the application withdrawn in writing prior to field inspection, the total fees paid will be refunded.

(*d*) If an area is rejected at field inspection, then the minimum fee of 10s. and the late entry fee, if any, will be retained and the balance of the fees paid will be refunded.

7. ***Brown-top.***—As in rye-grass, cocksfoot, and clover, except that—

(*a*) The charge will be at the rate of 1s. for every 20 acres or part thereof, with a minimum charge of 10s.

(*b*) Should both field inspection and paddock branding be deemed unnecessary, then the minimum charge of 10s. only will be made and the balance of the fee paid on that area will be refunded except as provided for late entry fees in 6 (*b*). If either field inspection or paddock branding is necessary these fees will not be refunded.

8. *Wheat.*—As in rye-grass, cocksfoot, and clover, except that the unofficial grain inspection is to be regarded as part of the field inspection.

9. *Potatoes.*—(*a*) There will be a sample trial fee of 10s. which must accompany the grower's application.

(*b*) There will be a second fee called a field inspection fee at the rate of 2s. 6d. per acre, with a minimum of 10s., which must be paid prior to crop inspection and not later than the 20th December in each season.

(*c*) An additional late entry fee of 10s. must be paid by each grower in respect to any fees, whether for sample trial or field inspection, received after the closing date. This fee must accompany either the sample trial or field inspection fees or both, and in no case will it be refunded except as provided in 9 (*d*).

(*d*) Should an application for certification be ineligible or be withdrawn in writing prior to the collection of samples, then the total fees paid in respect to sample trial will be refunded.

Should an application for field inspection be ineligible or be withdrawn in writing prior to field inspection and before the 20th December in each year, then the total fees paid in respect to field inspection will be refunded but not those in respect to sample trial.

(*e*) If an area is rejected at field inspection then the sample trial fee of 10s., the minimum field inspection fee of 10s., and the late entry fees, if any, will be retained and the balance of the fees paid will be refunded.

(*f*) Provided they comply with certain conditions, growers may market seed potatoes in wooden crates.

In such cases the Department will supply at no extra cost sticker certication labels in place of the certification tags adopted for use on sacks.

A charge of 6d. per hundredweight, with a minimum charge of 10s., will be made when sticker certification labels are required in connection with the packing in crates of seed potatoes that have already been passed as certified and for which certification tags have been issued.

MACHINE-DRESSING CHARGES.

GENERAL CONDITIONS.

10. All machine-dressing charges and those entailed in redressing, blending, and splitting are payable by the merchant who undertakes the work, whether on his own behalf or on behalf of another party. Monthly accounts will be sent out to merchants. In the case of private individuals dressing seed, all machine-dressing charges must be prepaid.

11. Machine-dressing charges will be made at the time when a sample is drawn for the purity and germination certificate, except that no charge will be made for resampling sealed sacks for the purpose of a fresh purity and germination certificate.

12. A charge will be made at standard machine-dressing rates for resealing and retagging certified seed which is opened for the purpose of redressing or blending.

13. A charge will be made at one-half standard machine-dressing rates for resealing and retagging certified seed which is opened for the purpose of splitting, with a minimum charge of 2s. 6d. for each occasion that an officer's services are required for this purpose.

14. There will be no charge made for the sealing of machine-dressed seed which is being held temporarily with the object of blending, *provided that at the time of such sealing the merchant furnished a certificate in writing that such dressed seed is being held temporarily for the purpose of blending at a later period* The full machine-dressing charges will, however, be made when such seed is blended and finally sealed, tagged, and sampled for a purity and germination certificate.

SPECIFIC MACHINE-DRESSING CHARGES.

15. *Rye-grass and Cocksfoot.*—Machine-dressing fee: 1½d. per bushel or part bushel of machine-dressed seed. The charge thus made on any one line must not be less than the amount computed at the rate of 6d. per sack or part sack.

16. *Clover.*—Machine-dressing fee: 1d. per 10 lb. (or part thereof) of machine-dressed seed. The charge thus made on any one line must not be less than the amount computed at the rate of 3d. per sack or part sack.

17. *Brown-top.*—As in clover.

18. *Wheat.*—½d. per bushel or part bushel.

—*Fields Division.*

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING SEPTEMBER, 1934.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list supplements those published in the July, August, and September issues of the *Journal*, and refers to those crops passed during September.

In the June *Journal* was published a list of growers who have received provisional certificates. The acreage, percentages of foreign varieties present, and the group number and classification representing the relative merits of lines were given in that list, to which intending purchasers should refer.

AUCKLANDER SHORT TOP.

Mother Seed—
Carroll, J., R.M.D., Southbridge.
McPhail, W. A., Mitcham, via Rakaia.
Nicklaus, J. F., 104 Ryan's Road, Fendalton, Christchurch.

Commercial Seed—
Gaffeney, Mrs M. F., Temuka.
Nairn, G., R.M.D., Lakeside.
Smith, G. G., R.M.D., Broadfields.

DAKOTA.

Mother Seed—
Chambers, L. J., "Carberry," Weedons.
Gardiner, C., Mitcham, via Rakaia.
Johnston, H. W., Dunsandel.
Jowers, G. C., R.M.D., Springston (Line B).
Morrish, F. E., Springston.
Seymour, J., Hawthornden Road, Christchurch.
Shellock, W., R.M.D., Te Pirita, Rakaia.

Commercial Seed—
Berry and Halliburton, 28 Dundas Street, Christchurch.
Carpenter, A. M. and F., Fernside, Rangiora.
Giles, N., Seadown, Timaru (Line A).

ARRAN BANNER.

Mother Seed—
Cooper, J., Croydon Road, Gore.
Government Pure Seed Station, Box 4, Lincoln.

ARRAN BANNER—*continued.*

Mother Seed—continued.
Hellyer, F. E., Macandrew Bay, Dunedin.

AUCKLANDER TALL TOP.

Mother Seed—
Cross, H. E., R.M.D., Weedons-Courtenay.
Eder, W., R.M.D., Sefton.
Government Pure Seed Station, P.O. Box 4, Lincoln.

Commercial Seed—
Beal, H. W., Eyreton, R.M.D., Kaiapoi.
Seyb, L., Washdyke, Timaru (Line B).

EARLY ROSE.

Mother Seed—
Burns, R. A. C., Te Pirita, R.M.D., Rakaia.

IRON DUKE.

Commercial Seed—
Government Pure Seed Station, P.O. Box 4, Lincoln.

MAJESTIC.

Mother Seed—
Cross, H. E., R.M.D., Weedons-Courtenay.

ROBIN ADAIR.

Commercial Seed—
Marshall, D., R.M.D., Leeston.

ARRAN CONSUL.

Mother Seed—
Government Pure Seed Station, Box 4, Lincoln.

—*Fields Division.*

SEASONAL NOTES.

THE FARM.

Control of Pastures in Summer.

DURING November and December pasture utilization should be designed to avoid as far as possible the development of flowering or coarse growth on pasture under grazing; as grass growth becomes more mature it becomes correspondingly more fibrous, less nutritious, and less digestible. In addition, bottom sward-forming species, such as white clover, may be hampered seriously. And, further, the more pastures are allowed to become tall and stemmy the more do they fall off in respect to their output of leafy herbage during a considerable and critical portion of the producing season—*i.e.*, during late summer and early autumn—whereas pastures which have not developed to the flowering-stage are characterized by a more continuous and greater production of leafy feed.

Much of the undue development of coarse summer growth of pastures would be obviated were ensilage exploited to the optimum extent. But even really judicious action relative to ensilage will not always give completely satisfactory control of the growth of pastures. Frequently, in practice, it proves impossible to assess exactly the area of grass sufficient to provide the feed required by stock. Farmers who rightly believe in good feeding prefer to have some feed to spare instead of being short of feed. A quantity of surplus feed that may arise in this way may not be sufficient to justify its being saved in the form of silage, but still it may be sufficient, if not dealt with, to lead to unsatisfactory control of the growth of the pastures. When this is so, the most satisfactory course is to check the development of coarse and stemmy parts in a field by topping of the pastures—*i.e.*, mowing the field to remove flower-heads. Often such topping is delayed until it is far too late to obtain the maximum benefit from it. Indeed, if topping is carried out close to the approach of the dry summer period customary in many districts, and if it leaves such a short stubble that increased drying-out of the soil is fostered during fine weather, then topping may have an undesirable result. Essentially, the purpose of topping is to remove flower-stalks and coarse growth, and it should lead to as little as possible mowing of fresh leafy growth suited for milk-production. Further, topping is to be looked upon as an emergency rather than as a routine measure—the occasion for it arises because more feed becomes available than was counted upon. From this it follows that if a substantial portion of a farm calls for topping, then judgment was astray earlier in the year in that sufficient of the grassland was not closed for hay and silage. As the feed available is governed to a considerable extent by weather conditions, which cannot be forecast, the necessity for topping may quite well arise even under highly efficient management. Normally, because of its stemmy nature, the topped growth is not of high value for milk-production. Dry stock often may be employed advantageously to remove such growth, which stock consume readily when it has become partly wilted, although they neglect it before it is mown. Even if it is impossible to provide for the consumption of the wilted, topped growth, it is sound practice in the interests of the future production of the sward to carry out topping made advisable by the nature of the growth. Topping may prove of distinct value in reducing the shading effect of tall weeds, which at times become established as the result of the breaking of the sward in the manner that is likely to occur in a wet winter or spring.

For thoroughly efficient control of the growth of pastures in summer ensilage and topping usually have to be linked suitably with systematic grazing. That suitable systematic grazing is not at all intricate may be gauged from the fact that the essential steps in effective grazing on many farms are the following simple ones :—

1. Rapid grazing of fields by relatively heavy stocking. Stocking at the rate of from six cows an acre upwards for periods of from one to three days has in practice given excellent results.

2. Subsequent complete " spelling " of the pastures to allow of recovery sufficient to give the amount of grazing already specified. According to the season of the year spells of from seven to fourteen days' duration have given good results.

Relatively hard grazing of the pastures is at no stage necessary—indeed, it is undesirable. Hence, systematic effective grazing does not call for punishing treatment of either the stock or the pastures. Intensive subdivision is not needed. Splendid results are being obtained on farms on which nine to twelve paddocks are under grazing. Of practical moment is the further fact that on many farms on which the subdivision is as good or better than this the results in respect to pasture utilization are far from satisfactory. These latter farms provide instances of unexploited facilities, of outlay from which potential returns are not obtained. On such farms, which are numerous, better utilization and increased consequent revenue could be obtained without any expenditure.

Ensilage.

Probably some who should practice ensilage still hesitate to do so because of the belief that it is either unduly laborious or that it calls for special experience. While it can be made laborious, it also can be made a light task, and a main objective should be the elimination of all tedious, unnecessary effort. The work relative to ensilage can be lightened greatly by intelligent preparation, for which there is still ample time on many farms. Conveniently located ensilage pits or trenches may yet be made. It is significant that in leading grass-farming districts trenches have grown in popularity in recent years. This is because suitable locations for trenches, which are really modified shallow pits, can be found on most farms. Experience shows that drainage is not of special moment in selecting sites for trenches, although, of course, a really badly drained site should be avoided. Trenches appeal to many because they can be made so readily and cheaply with horse labour. Further, not only do trenches reduce the labour of handling the heavy green material, but they allow of its being so well compacted by trampling, &c , that the wastage is reduced to a practically negligible quantity. Detailed information about the construction of trenches is available from local officers of the Fields Division.

Ensilage, far from being an intricate process, is considered by those with experience of it to be as a rule simpler and productive of much less worry than is haymaking. After very little experience it is possible to dispense with the taking of temperatures in determining the progress that it is advisable to make ; additional green material should be added to that already gathered as soon as the latter commences to sink in height because of the ensiling process. If this rule is followed, temperatures in the vicinity of 100° F. will develop and silage of a greenish to a yellowish tint usually will result. To follow this rule when the stack system is employed, if the weather is mild and there is not excessive water associated with the green material, it is usually necessary to proceed daily with the ensilage, but if the weather is cold and the green material contains much moisture because of either the weather or the stage of its growth, then it is likely to be advisable to refrain from bringing in green material on occasional days, especially in the early stages.

In pits and trenches where the partial exclusion of air may check the rate of the ensiling process, slower gathering of the green material than is advisable in the stack system is likely to be suitable. The production of the greenish to yellowish type of silage involves less loss in nutritive value in the actual ensiling process and results in a more digestible type of forage than does the production of brown to black silage. Even when care is exercised, late harvesting of the crop is likely to beget undesirably dark silage, unless the work is speeded up relatively to the procedure which suits for green succulent material. Late ensilage is further undesirable because it leads to—

(1) Less likelihood of a substantial leafy aftermath, which is usually of especial value in midsummer:

(2) Increased harm to permanent pastures due to prolongation of the shading effect of the tall growth:

(3) Unduly woody silage, which, irrespective of the curing process, is associated with the poor balance in the supply of nutriment and the poor digestibility that characterize any overmature pasture growth.

Early ensilage is specially advisable in the first cut of the season from a lucerne area. This is so because the first cut often contains a considerable proportion of weeds, and the longer such weeds are left unmown the more they weaken the lucerne-plants.

To sum up, inefficient ensilage commonly results in the presence of one or more of the following conditions:—

(1) Working at excessively high temperatures, which results in avoidable loss in quality. This may be remedied by more speedy work. Partial wilting of the material may also lead to excessively high temperatures, though in dealing with very succulent material partial wilting may be advisable.

(2) Too late cutting of the green material, which normally begets a falling-off in quality that outweighs any increase in quantity.

(3) Insufficient exclusion of air, which begets wastage due to decay; this may be remedied by more thorough packing in the pit or trench and by a more adequate covering of earth or other sealing material, which, to minimize wastage, should normally be placed in position practically as soon as all the green material has been gathered.

The Supplementary Crop Position.

At this season more and better work should be carried out in respect to such important supplementary crops as mangels, swedes, turnips, lucerne, chou moellier, and carrots. Top-dressing, ensilage, systematic grazing, all are of great known value, but for maximum success it is frequently necessary to reinforce them by judicious forage cropping. It is often asked to what extent should the plough be used on farms on which grass is the dominant crop. Relative to this matter detailed guidance capable of general application cannot be given with any measure of safety, but as a rule arable cropping should be given a place when two commonly occurring circumstances are present.

In the first place, generally, it will prove advisable when some of the pastures on a farm could be improved economically by ploughing, growing intermediate crops, and eventually resowing to pasture. In the second place, it is generally advisable to grow arable crops such as mangels, chou moellier, &c., when this can be done without necessitating a substantial direct outlay in equipment or labour. And this will apply as a rule even to farms the pastures of which are not badly in need of improvement by means of renewal. In short, if the work involved can be done without

detrimentally affecting the routine farm work and without necessitating the employment of additional labour, then almost certainly cropping should be carried out. Many farmers err not by omitting supplementary cropping altogether, but by not doing enough to meet properly the feed requirements of the stock during periods of shortage of feed from pastures.

Factors in Successful Cropping.

Despite the fact that the value of cultivation has been stressed through the centuries from classical times, poor cultivation is probably the most potent underlying cause of unnecessarily and unprofitably low yields. Expenditure on good seed and suitable fertilizer is at times at least partially ineffective because of lack of cultivation. Preparatory cultivation, which is of prime current importance, should provide for most arable crops a layer of soil fine, firm, and mellow to the full depth disturbed by the plough. Only by beginning the preparatory cultivation in good time can this be obtained economically. To some extent potatoes are an exception, in that they are favoured by a loose condition of the soil.

The saving of a few shillings and even a few pence an acre on seed sometimes is welcomed ; almost always it really is parsimony instead of economy. Usually the small saving is associated with one or all of the following : Poor germination, low vigour, poor type or strain. Complete or partial failures of crops which it is customary to attribute to unfavourable weather or to attacks of pests have been traced to low germination or to impaired vitality, leading to puny seedlings that succumb under adverse conditions that strong seedlings would withstand.

It may be taken as a practical rule in cropping that high production is dependent on high fertility, and consequently that liberal manuring is frequently advisable. In general, while the overmanuring of forage crops is practically unknown, the undermanuring of them is commonplace. Probably manuring of forage crops would generally be more liberal were it more widely realized that the value of 1 ton of even the least nutritious of ordinary forage crops is more than the cost of 1 cwt. of the fertilizer commonly used with them, and the response to fertilizer is certainly abnormally meagre if it does not lead to an increase in yield in excess of 1 ton an acre.

Root Crops.

The mangel is especially reliable both because it can withstand a period of dry weather relatively well and because it is not subject as yet in New Zealand to any serious disease or pest. Over wide areas, as the result of suitable treatment, crops of 60 tons or more an acre are frequently grown. Good treatment for the mangel is particularly desirable, and thorough preparatory cultivation to produce a fine, firm, seed-bed is an important feature of such treatment.

As the result of yields noted in the field the variety Prizewinner Yellow Globe deserves its outstanding popularity. Other varieties of known value are Red Intermediate, White Sugar, and Jersey Queen. Current practice which generally gives good results is to sow about 6 lb. of seed an acre in rows 26 in. to 28 in. apart. Over wide areas November sowing is suitable. In wet, cold conditions, which tend to cause loss or stunting of seedlings, sowing should be deferred until warm conditions obtain.

Though knowledge of the manurial requirements of the mangel is imperfect, it has been established that as a rule good results may be expected from a dressing of 5 cwt. to 6 cwt. an acre of a mixture consisting of equal parts of superphosphate and blood and bone or three parts of superphosphate to two parts of blood and bone. It is significant that in farmers' field competitions outstanding yields are so frequently linked with very rich soils—*e.g.*, old pig-yards, &c.

On free-working loams the field carrot, given good cultivation, is capable of heavy yields—ones of approximately 70 tons an acre have been recorded.

It is usually profitable to apply 3 cwt. to 5 cwt. an acre of a fertilizer mixture consisting of two parts of superphosphate to one part of blood and bone. Varieties which have been consistently popular are Matchless White, Barriball, White Belgian, and Guerande. Guerande, which is a very suitable variety for sheep, is grown successfully, without thinning, in rows 21 in. to 26 in. apart, 1½ lb. of seed per acre being used. With other varieties good results are commonly obtained by hand-thinning and cultivating crops sown in drills 21 in. to 26 in. apart, but sowing in drills 14 in. apart also gives heavy yields. Sowing 1 lb. to 1½ lb. of seed an acre in November usually gives good results.

Lucerne.

Rapid and vigorous growth of lucerne seedlings is desirable, and is favoured by warmth. Because of this, best results are usually obtained by sowing during the latter part of November or in early December. It is good practice to sow through every coulter of the grain drill 12 lb. to 18 lb. an acre of Marlborough seed. Alternatively, the seed may be broadcast and covered by light harrowing. A fine firm seed-bed is required for fullest success with this valuable crop. As a rule, lime may be applied advantageously before the final cultivation preceding seed-sowing. Treatment of the seed with suitable cultures, which are obtainable at a small cost from the Department of Agriculture, is advisable. Full information about this and lucerne culture generally is contained in Bulletin No. 155, which is available for free distribution.

R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Control of Pests and Diseases.

In times such as the present, when low prices for fruit usually have to be accepted, it is particularly important for growers to pay special attention to cultural practices and orchard management generally. Without a high state of efficiency in these, profit from fruitgrowing is not to be expected. There have been seasons when a profit could be shown on orchards managed in a haphazard way, but conditions have now changed, and growers who are unable to keep up with the ever-varying methods of good orchard management are doomed to disappointment. Success is largely dependent on producing consistently good crops of fruit of the desired size, free or almost free from disease or insect injury, and at the least possible expense. While the expense must be studied, it should invariably take second place to the other essentials.

Sprays recommended in last month's notes should be applied as the different varieties reach the correct stage of growth, aiming always to make the applications a few days on the early side rather than the late, to allow for the risk of unfavourable weather delaying the operation. For apple-trees it is particularly important to apply the petal-fall spray early where powdery mildew has to be contended with. Lime-sulphur, 0·1 per cent., colloidal sulphur, 2 lb. per 100 gallons, and lead arsenate, 1½ lb. per 100 gallons is an extremely efficient combination spray, and when applied early seldom affects the setting of the fruit from the late blossoms. The second post-blossom spray should consist of the same combination, applied from ten to fourteen days after the petal-fall spray.

Leech is likely to make its appearance on the leaves of the pear, plum, and cherry at an early date. This pest is readily controlled by periodical sprayings with lead arsenate, 1½ lb. per 100 gallons. The first application

should be made immediately the leech or leech-eggs are observed. At this time the fruit is not far advanced, and is not likely to have its appearance marred by the spray. Good control of this pest early in the season may make it unnecessary to stain the fruit when nearing maturity by further applications of lead arsenate.

The importance of constant vigilance for fireblight infection cannot be overstressed. Late-flowering varieties of apples such as Sturmer, Ballarat, Statesman, and London Pippin are most prone to blossom infection. All diseased portions should be severed well below the visible infection and immediately burned.

Cultivation.

Where a good tilth has not already been secured, every opportunity should be taken after rain to secure such a condition. The soil should be kept friable, devoid of lumps, and with an even surface without a crust, so that the smallest surface area is exposed to drying winds, moisture conserved, and aeration maintained. Aeration will materially assist the action of the bacteria in the soil in changing the unavailable plant-food already in the soil and that supplied by manures into a form in which the trees can absorb it, thus stimulating tree growth, helping the development of fruit-buds, and increasing the size of the fruit.

Thinning Stone Fruits.

Thinning of the fruit is usually necessary on most varieties of peach, apricot, and plum. This work is best attended to as soon as the natural dropping is over. Much depends on the vigour of the tree, variety, susceptibility to brown-rot, &c., as to the extent of thinning necessary. It is a good practice to thin heavily on trees making poor growth, leaving a heavier crop to mature on the more vigorous trees. Generally it is advisable to reduce all clusters to single fruits and thin the remaining fruits so that when fully matured the fruit will not be touching each other. This is of particular importance in localities where bronze-beetles are usually troublesome, and on varieties very susceptible to brown-rot infection. The leaf-roller caterpillar that frequently injures the stalks of apricots is also more readily kept under control if single fruits only are allowed to remain.

Grafts.

Trees that have been grafted in the spring will require constant attention. Frequent examinations are necessary to see that the growth of the scion or other shoot growth has not caused the grafting wax to crack. The sealing of such cracks, so as to exclude the air from the union, often saves the death of the scion. In cases where it has become evident by the second week in November that no union has taken place, further scions can then be inserted to take the place of the failures. While this is much later than the recommended date for grafting, satisfactory results can sometimes be secured by grafting during this period, and thus save a year in establishing the scion. The numerous shoots that usually come from the stock should be allowed to remain, provided there is no danger of the scions being crowded. All such shoots should be pinched back periodically so that the scions remain well above the other growth.

—P. Everett, Orchard Instructor, Gisborne.

Citrus Notes.

As soon as soil conditions are favourable during the spring, growers should work the ground to as fine a tilth as possible. At the same time care must be taken not to damage the feeding roots by cultivating too deeply. Thorough tillage of the soil during the spring and early summer is important, and should under no circumstances be neglected.

Soon after the main crop of blossoms has set it is advisable to spray the trees with bordeaux mixture 3–4–50 as a preventive of verrucosis and grey scab, and, as the flowering period is considerably extended, more than one application is necessary to ensure clean fruit. A watch should be kept for scale insects and thrips, which become troublesome in the early summer. The trees should be sprayed with one of the oil dilutions at a strength of from about 1–40 to 1–80 according to the brand of oil used. For the accuracy which is very desirable see Bulletin 161, which is available for free distribution. It would be much safer to make several applications throughout the season at a weaker strength, rather than risk damage by trusting to one application at the greater strength. Moreover, owing to the fact that the red scale hatches out during January and February, it is necessary to keep a sharp lookout and spray accordingly. As thrips are becoming more troublesome, all spraying should be done thoroughly in order to cover the under sides of the leaves.

To allow for the development of the new season's crop all fruit should be removed as soon as it reaches the diameter of about 2½ in. When picking, a sharp lookout should be kept for signs of borer. Small branches affected are easily detected by the wilting of the foliage, and can be cut out and burned. Larger affected branches can be dealt with by injecting benzine into the holes and plugging them with soap or putty.

Trees which appear sickly should be carefully examined for signs of collar rot or bark blotch, and when these troubles are detected they should be treated by the removal of all diseased bark together with a small portion of healthy bark round the edges of the wound, which should then be painted over with bordeaux paste or Stockholm tar.

—*L. Paynter, Orchard Instructor, Auckland*

POULTRY-KEEPING.

Special Care of Late-hatched Chicks.

LATE-HATCHED chicks are always at a decided disadvantage compared with the early-hatched bird, so that if they are to develop into desirable stock they must receive the best possible attention after leaving the brooder. Too often the late comers have to follow stock hatched earlier in the season, and are compelled to run on stale and tainted runs, and this is all against their making satisfactory growth. The worst mistake that can be made in this connection is to place the young birds on runs to which adult stock have frequently had access, as the chickens are liable to become infested with internal parasites—worms, coccidiosis, &c. Just as that dangerous disease, tuberculosis, can be passed on from one bird to another through the droppings, so the germs of parasitic life can be transmitted in a like manner. Adult stock may do fairly well when intestinal parasites are present, but to chickens during the developing stage these parasites are fatal. The importance of having the young stock on clean ground whenever it is possible to do so must therefore be stressed. Too many poultry-keepers are not aware that intestinal parasites, worms, &c., are often responsible for heavy losses in comparatively young chickens, say, from eight to ten weeks old. Scores of such cases have come under my notice, and in almost every case the trouble could be traced to tainted ground. Above all, chickens, or, in fact, birds of any age, should not be given access to a manure-heap which has been collected from time to time out of fowl-houses, or intestinal parasites are almost sure to give trouble.

It must be emphasized again that if the young birds are to develop into vigorous and profitable stock they must have all conditions in their favour, and nothing is more conducive to this end than clean ground to run on.

In these notes alternate runs to a poultry-house have always been recommended, in order that the birds may have frequent changes to clean ground after it has been cropped and rested, and long experience in utility poultry-keeping has only strengthened, to my mind, the importance of this practice. On all plants an endeavour should be made to turn over and sow down a certain number of runs each year, so that the young stock, after being transferred from the brooder, may have frequent changes on to clean fresh ground. Many breeders sow down a number of runs with rape, kale, &c., for the reception of chickens after leaving the brooder. This is an excellent idea, as not only are the young birds provided with all the green food they require, but, in addition, they can secure shelter from winds, and the desired shade from the hot summer sun.

The Surplus Cockerel.

The necessity for marketing all cockerels not required for future breeding purposes as early as their age and condition warrant should be kept in mind. There is no greater drain on profits of poultry plants than the keeping of cockerels beyond a marketable stage, say, from four and a half to five months old, or before the adult plumage commences to appear, as it is impossible for a bird to produce feathers and flesh at the same time. The amount of flesh a chicken will put on prior to producing its second feathers is surprising, providing the chicken has been well fed and maintained in a healthy thriving condition from the day it leaves the shell. It is surprising how rapidly birds will lose condition when the second feathers commence to appear. The check in development of flesh with the appearance of the new covering is due not so much to the sudden and new demand on the bird's constitution as to the fact that at this age birds commence to indicate the natural propensities of development even when running by themselves, by sparring and fighting and generally taking considerable exercise, especially with the lighter breeds, all of which checks flesh-production.

If the birds, therefore, are to show a profit, especially in the lighter breeds, they should be marketed before the appearance of the adult plumage. If the birds are allowed to go beyond this stage, and it becomes necessary to put the desired condition on the matured frames, the cost of production may easily prove too great to leave any profit even in the case of a well primed bird. When catering for the high-class table trade it is quite probable that more money will be secured from a prime bird at five months old than will be obtained for it if marketed in good condition at seven months or older, at which stage it is generally termed by poulterers a "stag." At the former stage the frame is covered with delicate flesh, while at the latter stage the flesh is "staggy."

When priming cockerels, it is a good plan to limit the size of the run and so curtail the means of exercise. Under these conditions, and if given ample food, the birds will rapidly produce flesh, and it should be remembered that one fatted bird is worth more than two unfatted, even in markets such as ours, where, owing to the limited number of choice table-birds which reach the market, many of the consuming public have not yet been educated to know what the taste of real choice chicken is. It is inadvisable to try to prime cockerels on inferior or damaged food. If they are to rapidly put on flesh, the food should be sound and fed with a free hand. Only soft food should be given during the priming process, as hard grains are apt to bring on digestive troubles when the birds are confined to a limited space. A suitable mash may be made from two parts of bran and one part each of finely ground wheat-meal and maize-meal, the whole being moistened with hot water or, better still, skim-milk, and mixed to a crumbly mass. Succulent green material may be fed in abundance, but separately, and where skim-milk is available it may be given in large quantities to drink. Those who have prime cockerels for disposal should endeavour to have these sold by weight. For such birds to be sold by the pair as is the common practice

now adopted is an unsatisfactory system both to the producer and the consumer. When selling birds by weight every ounce of flesh means increased profit to the producer and greater satisfaction to the consumer.

Classification of Stock.

One cannot emphasize too strongly the importance of classifying the young birds according to their size and age, remembering that the more evenly the birds are graded and the smaller the number put together the better they will thrive. This applies to the younger members of the flock in particular. It is a common practice, but nevertheless a mistaken one, to feed both the young and the adult stock on the same class of food. Frequently the morning mash contains a high percentage of forcing material, such as meat or meat-meal, and this is supplied to all members of the flock irrespective of age. Such food is specially necessary in the case of the laying bird, particularly when it is intended to cull her at the termination of her laying season. With the young bird, however, such a forcing diet is quite unnecessary. The food supplied at this stage should contain the elements needed to built up frame and bone rather than to develop the egg organs, or, in other words, to encourage prematurity, a condition that the overfeeding of meat is sure to bring about. Generally, after a pullet commences to lay she grows very little, so that if a bird commences to lay at an early age it will remain a diminutive specimen of its breed, and thereby fail to produce a good marketable egg.

It is a sound policy to give a good supply of animal food to chickens, say up to eight weeks old, but from then on and until the pullets are well developed, and particularly if it is observed that the pullets show signs of coming too early to maturity, all forcing food such as meat or its substitutes or even milk should be left out of the ration. Sometimes when meat is withdrawn from the ration the birds will crave for animal food and commence to pick each other, and this is apt to cause heavy mortality. In such cases the only safe course is to place a hopper of meat-meal in reach of the birds at all times. This will certainly not tend to retard the time of commencing the laying period, but in such cases it is better to allow nature to take its course than to have the birds picking each other.

One of the worst features connected with the industry at the present time is the tendency to market smaller eggs. This tendency will never be corrected, but will, on the contrary, be encouraged if pullets are to be forced to commence laying before they are thoroughly fitted for the work. Reference is not made here to the well-developed bird, but to the pullet which commences to lay when only a little more than half the standard weight of its breed.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Artificial Increase.

ARTIFICIAL increase may be accomplished in several ways, but perhaps the most satisfactory is by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey, and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for the mating of queens for renewal, and at the end of the summer—if two or more are united, or if each one is reinforced by the addition of bees and brood from strong colonies—they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation.

In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and preferably putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done, he may search for the queen and remove her while the division is being made, afterwards putting her in the hive on the new stand. The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming, and saves a great deal of trouble where increase is desired.

Supering.

In most districts November is early enough for the employment of supers, though much depends on weather conditions. If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added at any time. However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required, it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can either be allowed to swarm naturally or be divided artificially. When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available one or two combs—not containing brood—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation, and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

Care of Bee-yard.

Before the supers are put on it is advisable to see that the hives are raised well above the ground, so as to provide ventilation underneath and also to prevent the hives becoming a shelter for insects. The bottom-boards should be raised at least the height of a brick from the ground, and they may even be a little higher, though in the latter case the alighting-board should be long and sloping to enable the heavy-laden workers to reach the hive easily if, as so often happens, they miss the entrance when descending at the end of their homeward flight. All grass and weeds should be cleared away from the hives, particularly at the entrances. To save the continual labour of this operation during the spring and summer it is a good plan to skim the weeds from the ground and to spread agricultural salt in the proportion of about 6 lb. per hive to prevent their reappearance for the season. Although this is only a temporary remedy, it should save mowing the grass for at least one season. Whatever the labour, the entrances must be kept free; the bees' lives are all too short and arduous, and the energy wasted in forcing their way through the tangle of weeds sometimes seen in apiaries must amount to a good deal in the course of a season.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Summer Cultivation.

MUCH has been said about the importance of the proper preparation of the land for planting and sowing, especially for perennial crops. But to make the best of all the circumstances some attention is necessary for most horticultural crops after they are planted. If the preparation of the land has been given time as well as labour, weeds will have had time to show up and be eradicated, and so simplify very much the attention necessary after planting. Where fine seeds are concerned such conditions are indispensable. During the early stages of growth of any of these crops the competition of weeds for the supplies of water, air, and light is a serious hinderance to their progress until they have become established. Many soils also are inclined to form a crust which hinders the liberation of minerals by oxidation and bacterial action, and facilitates the liberation of moisture, often to an extent that becomes injurious. To break up this crust and maintain a good tilth, shallow cultivation should be given during fine weather as often as may be necessary, this will also ensure the destruction of weeds in the small seedling-stage when it is most easily accomplished. The cultivation at this stage should usually be shallow, otherwise fresh weed seeds are brought to the surface where they grow, and there is the danger of disturbing the roots of the growing crop. These important operations are too often neglected owing to the amount of work requiring attention at this season and the changeable weather affording few opportunities; but their importance demands that preference should be given to them whenever the soil and weather are suitable. The danger mentioned disappears as soon as the crop covers the ground between the rows—the shade cast keeps the ground moist and discourages the growth of weeds.

The thinning of seedling crops, when necessary, is also an attention that cannot be neglected with impunity. With experience, and a knowledge of the germinating percentage of the seed, it may be sown at a rate which will ensure a good strike, with little or no thinning necessary; but the heavy seeding generally made necessitates thinning as soon as the plants are large enough to handle—it is indispensable where good root crops are to be harvested. Another useful form of cultivation at this season of the year is the summer fallow. By this means land that is seriously infested with bad weeds, such as couch-grass, &c., may be carefully worked during dry weather to collect the roots and dry and burn them. Given good dry weather, a summer fallow is an effective method of cleaning foul land and getting it into high condition for cropping. To begin with, it is advisable to plough no deeper than is necessary to get rid of the weeds.

Vegetable Crops.

In addition to thinning seedling vegetable crops and cultivating the ground, as suggested in the above paragraphs, young celery-plants, in the seed beds and when planted out, should be sprayed with bordeaux 3–4–50 at intervals of about three weeks for the control of leaf-spot, a fungous disease which is the cause of considerable loss annually where spraying is neglected. Dusting young plants of the cabbage family, as recommended in last month's notes, for the control of caterpillars, should also be continued as necessary.

Half-hardy crops should be planted or sown during the early part of November, if it has not been done previously; they include dwarf and tall beans and such gourds as marrows, pumpkins, melons, and

cucumbers. In a rich light moist soil that is well sheltered, these crops should be profitable. Towards the end of that month plant out Brussels sprouts and sow swede turnips. The latter are most suitable for the cooler districts; where it is desired to grow them in the warmer localities an autumn sowing generally produces the better roots.

The celery crop requires a rich soil that is moist at all times; to obtain these conditions on light land, especially in the drier districts, it is necessary to grow the crop in prepared trenches. Such preparation as is necessary should be done in good time, so that the land is clean and well settled before planting takes place.

To keep an asparagus crop in good strong condition, the cutting of the young spears must not be continued for too long a period: a three-year-old plantation may have the young spears gathered for two or three weeks, if the plants are in good condition. This cutting period may be prolonged each year, until about the fifth or sixth year a full cutting season of about eight weeks may be adopted, finishing usually towards the end of the month of November. Then, if the crop lacks vigour in any respect, a good dressing of fertilizers may be applied to encourage the vigorous growth necessary to improve the crop next cutting season. In this regard it is to be remembered the crop is partial to potash, especially if the soil is light.

Tomato Crops.

In the unheated glasshouse the tomato crop usually commences to ripen now, and picking starts towards the end of the month of November. Exhausted leaves about the base of the plant may be trimmed off and carried out and burnt. On light soils inclined to be overdrained a mulch of strawy stable manure may be laid to feed the roots and retain moisture. Where the bottom bunches have set well there is a considerable demand on the plants, and to obtain good bunches higher up on the vines a liquid manure composed of fertilizers in solution should be applied at intervals of about a fortnight A sharp lookout should be kept for green or white fly, and the house fumigated on their first appearance; black stripe and mosaic disease will require watching owing to its prevalence during past seasons. It is to be remembered the best preventive is good cultural conditions. If these are maintained many troubles are outgrown. There should be no mistake about this—rank growth is not a good normal state for this crop. While the growth should be sufficiently vigorous, it must be of good firm texture, with plenty of blossom. It is at this season that air should be admitted generously if leaf-mould disease is to be avoided. When a large proportion of the foliage is destroyed by this fungus, the fruit is starved and fails to fill out satisfactorily; to avoid this, good ventilation must be maintained continuously, and in hot, close weather ventilation facilities will require to be used to their fullest extent. Resistance will be best, with this disease as with others, where the foliage is stout and firm instead of being thin and soft.

Outside, the tomato crop is just getting established during the month of November. A sharp lookout should be kept for any replacements necessary, as they should be made with as little delay as possible. The work then consists chiefly in removing lateral growth before it exceeds 3 in. in length, and training the plants to one stem. These are tied at intervals of about 1 ft. to the stakes or wires placed there for their support. In very dry districts only are the plants sometimes allowed to crop on the ground without support and very little training; the plants probably being thinned to four growths and stopped after a couple of bunches have set. Cultivation must be maintained meanwhile to suppress weeds and make plant-foods available. In doing this much damage is commonly done by prolonging the period of deep cultivation

and interfering with the roots, thus weakening the plants and disposing them to the attack of any diseases that may be present. Where the land has been well prepared a firm bed with shallow cultivation will usually give the sturdy fruitful growth that is desirable.

A few years ago the small tomato-moth caused some consternation by suddenly destroying fine crops just as the fruit had set, but before it had time to ripen. The attack, which was without precedent, was confined to the collar of the plant, and was unnoticed generally until it was too late. It has been prevented since by spraying, that portion especially, with arsenate of lead during the early summer. Vigilance and prompt action when necessary will prevent this attack recurring: the danger is greatest when long periods of fine weather occur at the season mentioned.

Small-fruit Crops.

In a rich light soil in warm localities Cape gooseberries may now be planted out 3 ft. apart and 6 ft. between the rows. If the land is well prepared the plants will probably have a satisfactory crop annually for two or three seasons, if attention is given them in the way of cultivation and fertilizers. These autumn berries ripen when fruit of that class is rather scarce, and preserves made from them are deservedly popular.

The passion-fruit is another crop which is planted out at this season in well-sheltered localities. It comes into bearing the second season after planting, and with good treatment the crops should be profitable for a period of six or seven years. Plants are sometimes found carrying a heavy crop under very poor conditions, but to maintain a good cropping record and produce well-flavoured fruit the land should be good and well prepared. Plants are now usually set 10 ft. apart and 9 ft. between the rows. The vines are trained on a post-and-wire fence: the posts being 5 ft out and 2 ft. in the ground with two top wires, one on each side of the post, the wire below being 2 ft. from the surface of the ground. A light stake should be inserted and tied to the wires for each plant, which should be set firmly at the base of the stake and trained up it by stopping each lateral after a few leaves have formed.

To maintain moisture in the beds and keep the berries clean, it is necessary to mulch strawberry-beds as soon as the crop commences to set. Mulching is often preceded by a good dressing of guano or other organic or chemical nitrogenous fertilizer which is worked in before the straw mulch is laid. Where straw is not available, rushes make a good substitute between the rows with pine-needles about the plants; any kind of hay is unsuitable owing to the many seeds it contains. The fruit can be very attractive if it is presented in a suitable manner; the demand depends very largely on doing this properly. Clean punnets well filled with selected berries picked with a short stem look well and sell readily. Undersized and misshapen berries should be placed in a separate receptacle for culinary use. All ripe berries must be gathered or they will be overripe at the next picking, and if packed will crush and stain the containers. For local and immediate use the berries should be well coloured; for long distance shipping, especially in warm weather, they should be less mature. In humid localities where brown rot is present long-distance shipping should not be attempted. The realization from a crop depends very much on the careful supervision of pickers to see that these principles are consistently maintained.

The Homestead Garden.

Towards the end of the month of November, when half-hardy annual bedding plants are in their flowering quarters, biennial and perennial

plants, such as wallflowers, stocks, polyanthus, pansies, &c., may be sown, often in prepared beds outside, for autumn planting and flowering during the following spring.

Where it is necessary to lift spring flowering bulbs, they should be carefully marked when in flower and lifted as soon as the foliage turns yellow. They should be lifted at once as soon as this happens, as in many instances the period of rest is very short and growth quickly recommences. Take them up when the soil is dry and spread them in a shaded, airy place to ripen. They should then be placed in shallow boxes, carefully labelled, and stored in a cool ventilated shed until they are replanted.

To obtain the best results in the herbaceous border, staking and tying should now be attended to as required. Well-regulated growth neatly secured will greatly improve the appearance of this section.

Nurseries and public gardens should be visited to study the new roses and other novelties to note their response to local conditions. Success of any kind in the garden depends very largely on carefully studying the reactions of all kinds of plants to the local conditions. It is only by selecting trees, shrubs, and herbaceous plants that are quite suited to these conditions and arranging them in a tasteful manner that a larger measure of success may be attained. With very few exceptions there are possibilities for great improvement along these lines.

—*W. C. Hyde, Horticulturist, Wellington.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 9th August to 20th September, 1934, include the following of agricultural interest:—

No 69977: Weed-killer, W. Cassels-Brown No 7057- Electrically heated incubator, L. J. Hayman No. 71093: Fungicide; Stanco Inc. No. 71556: Pulsator; T Shiels. No. 71811: Inflation for teat-cup; J. G. Lamb No. 70031: Opening gates, B. F. Whitney No. 72455: Pulsator, J. E Haywood. No. 70529: Preserving meat; J. Brooks, T. Moran, E. C. Smith. No. 71594: Milk-cooler; W. M. Peacock. No. 72568: Comb-honey packing; H. F. Dodson.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

Caseous Lymphadenitis: Relative to caseous lymphadenitis, the annual report of the officer in charge of the Veterinary Laboratory, Wallaceville, states: " While the South Island flocks under trial showed a considerable reduction in numbers affected down to the vicinity of 2 per cent. below which it is difficult to reduce the disease, the North Island flock under investigation has risen from last year's 2·7 per cent. almost to its first-flock percentage of just over 3 per cent. There has been a change in glands affected in the North Island flock, for the majority of the abscesses palpated this year have been found in the supramammary glands. This fact, taken in conjunction with a very much lessened incidence of caseous lymphadenitis in dry ewes, suggests that two factors operating in the North Island flocks under observation are of greater importance than the shearing factor. These are crutching and lamb carriage of the disease from ewe to ewe by mismothering at docking. Crutching wounds must become infected in places other than yards and sheds, and possibly in the more heavily stocked areas some consideration must be given to sheep night camps."

WEATHER RECORDS: SEPTEMBER, 1934.

Dominion Meteorological Office

NOTES FOR SEPTEMBER.

APART from the rather severe cold spell from the 10th to the 12th, September was a pleasant month with mild temperatures. The greater part of it was dry in nearly all districts, but practically all recorded good rains at some period, and the spring growth of vegetation set in with great vigour. Generally, the season is further advanced than usual, but the reverse is the case in South Canterbury. There is abundant pasture everywhere and stock are doing well. In some localities there were considerable losses of lambs in the cold weather referred to above. Owing to the sodden state of the soil less wheat has been sown in Canterbury than was intended.

Rainfall.—Heavy rains were recorded in the Auckland Peninsula, mainly in connection with two cyclonic depressions which affected that area. Over practically all the remainder of the North Island the rainfall was very much below normal. In the South Taranaki Bight area it was the driest September for many years. In the South Island, Nelson, the West Coast, and parts of southern Otago and Southland experienced a dry month. Elsewhere, chiefly owing to heavy rains on the 24th and 25th, totals were unusually high.

Temperatures.—The reports so far received, with the exception of that for Hastings, indicate that over the North Island temperatures were above the average. At Hastings there was some cold weather at the beginning of the month with some severe frosts, and this caused the mean to be low. In the South Island conditions were very variable. Thus, while Timaru had a cold month, Christchurch and Waimate were rather warmer than usual. The average for the whole Island differed little from normal.

Sunshine.—The amount of bright sunshine was generally about average. Blenheim reports 211·2, Nelson 207·2, Lake Tekapo 188·9, and Napier 175·1 hours.

Storm Systems.—On the 1st some snow fell in the far South in the rear of a depression which had just passed eastward. It failed to extend far northwards, however, and soon ceased.

Between the 3rd and the 6th a rather vigorous cyclonic depression moved from the North Tasman Sea past the extreme north of New Zealand. It produced easterly gales in North Auckland and heavy rains there and in the north-east of the North Island. In the Auckland Peninsula there were rather severe floods. South of the Auckland Province light rain only was recorded.

On the 8th a trough of low pressure lying in a north to south direction advanced on to the Dominion. Next day it passed eastward and was followed by southerly gales. Fairly general rains occurred with some heavy falls, especially in eastern districts. There were also widespread snow and hailstorms. The snow came low down on the hills in both Islands, and the falls were unusually heavy. From the 10th to the 12th was one of the coldest spells experienced this year.

A slight westerly depression passed on the 19th, but without affecting the weather greatly. Throughout the greater part of the month, indeed, it was remarkable how little rain fell on the west coast, even in strong north-westerly winds.

The next storm, that of the 23rd to the 27th, was the one that produced the most rainfall. Large amounts were registered almost generally. A certain amount of flooding occurred again in North Auckland and on the east coast between Timaru and Dunedin. The storm was a depression of cyclonic form which travelled from Cape Maria van Diemen across the North Island to Cook Strait and thence away eastward. North-easterly gales occurred in the north during its passage.

During the last three days a series of westerly depressions began to pass causing north-westerly gales, which gradually extended farther northwards over the Dominion On the night of the 30th, strong gales occurred about Cook Strait and in the Taranaki and Wellington Provinces. Rain fell in western districts and in the south-west of the South Island was very heavy. To the end of the month, however, the falls elsewhere had been mainly light.

RAINFALLS FOR SEPTEMBER, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.	Total for Year to Date.	Average for Year to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	6·33	14	1·60	4·90	48·57	43·66
Russell	10·79	11	3·72	3·89	67·06	41·19
Whangarei	7·79	14	3·40	4·85	51·05	49·95
Auckland	2·08	12	0·63	3·70	37·82	34·96
Hamilton	2·64	12	0·67	4·32	33·36	37·43
Rotorua	2·51	9	1·47	5·07	39·15	41·83
Kawhia	2·26	14	0·54	4·57	36·51	40·75
New Plymouth	2·05	11	0·85	5·01	39·57	45·32
Riversdale, Inglewood	3·86	14	0·84	9·56	60·04	77·16
Whangamomona	0·29	3	0·13	7·11	44·23	56·10
Hawera	1·91	10	0·59	3·42	30·12	33·53
Tairua	5·49	14	1·50	4·92	46·18	50·63
Tauranga	4·59	13	1·33	4·34	44·52	40·29
Maraehako Stn., Opotiki	2·73	10	0·88	4·21	36·02	41·94
Gisborne	2·13	9	0·49	2·99	22·22	37·28
Taupo	2·47	9	0·66	3·82	32·05	33·12
Napier	1·92	12	0·63	2·25	22·83	28·22
Hastings	2·07	13	0·63	2·63	19·84	26·05
Whakarara Station	5·79	11	1·81	..	39·57	..
Taihape	1·75	12	0·48	3·15	23·36	26·62
Masterton	2·59	13	0·70	3·02	27·99	29·66
Patea	1·70	11	0·50	3·59	29·32	33·03
Wanganui	1·94	11	1·24	2·87	25·74	26·72
Foxton	0·64	6	0·20	2·40	23·77	23·73
Wellington	2·21	11	0·67	3·11	34·28	31·93
South Island.						
Westport	3·91	17	1·02	8·30	67·38	70·80
Greymouth	4·65	18	0·90	8·09	71·19	73·06
Hokitika	4·55	17	0·92	9·16	71·81	82·25
Ross	5·99	12	1·62	12·43	89·14	94·81
Arthur's Pass	12·85	10	3·05	15·29	123·01	111·36
Okuru, South Westland	17·29	16	..	11·89	..	105·69
Collingwood	4·06	12	2·03	9·31	72·02	71·76
Nelson	1·59	7	0·46	3·64	26·62	28·42
Spring Creek, Blenheim	3·26	8	1·30	2·59	23·68	23·23
Seddon	2·71	11	1·61	2·14	21·97	18·76
Hanmer Springs	2·92	14	0·66	4·58	41·45	33·97
Highfield, Waiau	2·39	9	0·50	2·99	29·19	25·52
Gore Bay	3·14	12	1·64	2·94	32·21	24·25
Christchurch	2·93	13	1·22	1·73	23·85	19·19
Timaru	2·77	8	0·85	1·92	21·45	16·35
Lambrook Station, Fairlie	3·26	9	0·93	2·18	23·71	18·31
Benmore Stn., Clearburn	2·91	15	0·95	1·93	19·55	17·95
Oamaru	3·27	10	1·17	1·64	19·71	16·08
Queenstown	4·85	13	1·77	2·54	27·59	21·79
Clyde	1·56	9	0·56	1·05	13·88	10·50
Dunedin	6·02	12	2·75	2·73	35·19	26·93
Wendon	2·19	8	0·85	2·42	22·72	21·69
Balclutha	2·68	12	0·93	1·89	27·22	18·16
Invercargill	3·14	17	0·80	3·21	32·05	32·88
Puysegur Point	5·08	18	0·86	6·36	53·62	61·71
Half-moon Bay	5·12	20	0·94	5·02	38·23	42·94

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PRECAUTIONS WHEN COW "SLIPS."

P. W. B., Avondale :—

Two days ago I had a cow "slip" her calf in a certain paddock and wish to know—(*a*) For how long should I keep the paddock closed to cattle ? (*b*) Would it be quite safe to work and graze horses, including a mare in foal, in the paddock ?

The Live-stock Division :—

The answers are—(*a*) There is no definite guide as to how long it will take a soiled paddock to be safe, as moisture and heat will indefinitely prolong the virulence of the organism. However, experimentally infected material from cows having been collected and dried has been found to retain its virulence for 120 days but not more than 150. It would be better if you could plough the paddock up after liming and put a crop in. If you run cattle other than in-calf dairy cows for a season, that ought to suffice. (*b*) It would be quite safe to work and graze horses, or mare in foal.

PAMPAS GRASS IN TARANAKI.

A. B. G., Warea, Taranaki :—

I have at the back of my farm some 14 acres of bush in which are numerous clear spaces of about a ¼ acre. These clearings are badly infested with ragwort each year, so that I hope the pampas will be a means of not only having extra winter and drought period feed, but also keeping such weeds as ragwort and blackberry under. If frosts do no material harm to the plant, would the end of July be too early for me to plant ?

The Chief Chemist :—

Pampas will probably do very well in your warm climate, and it would not be necessary to plough the land. No actual experiments have been made to determine how root cuttings of pampas will compete with ragwort at the critical stage when the cuttings are first becoming established. Possibly the ragwort would have to be controlled until the pampas had made a certain amount of growth. It is considered that the end of July would be a suitable time for you to plant pampas in your district.

TREATING MOSS IN UNPLOUGHABLE PASTURES.

G. H. M., Otaui, Wanganui :—

I should be obliged if you will inform me of the best method of eradicating moss from pasture too hilly to be ploughed.

The Fields Division :—

The invasion by moss of a pasture generally indicates certain faulty soil-conditions which are reflected in the lowered vitality of the pasture-covering. As fertility is a dominating factor, it is suggested that you should top-dress with from 2 cwt. to 3 cwt. per acre of a phosphatic manure, such as super or slag. This procedure would invigorate the pasture, and incidentally encourage stock on to the worst areas and bring about trampling and breaking the surface, which in turn would effect a certain amount of soil aeration and suppression of the moss. Moss always thrives best where the surface of the soil becomes poor. If the moss is developed thickly over the surface it may be necessary to use cattle to break it up sufficiently.

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NARROW-LEAF—A VIRUS DISEASE OF TOMATOES.

PRELIMINARY INVESTIGATIONS.

E. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North.

SPECIMENS of tomato-plants, exhibiting symptoms which differed from those of any of the then known tomato diseases occurring in New Zealand, were received in January, 1933, from Gisborne and Hastings. Since, on a search through the available literature, no description could be found of a tomato disease showing similar symptoms, it appeared probable that the disease had been hitherto unrecorded. The name "narrow-leaf" is suggested for the disease on account of the characteristic narrowing of the leaves.

During the summer of 1933 narrow-leaf became very prevalent in and about Gisborne, and in two commercial gardens, one within the town itself and the other at Hexton, about five miles distant, 50 per cent. infection was recorded. The disease was again present in the Poverty Bay and Hawke's Bay districts during the 1933-34 season.

SYMPTOMS.

The symptoms of the disease in the field and the glasshouse are very similar. In the field the plants may become infected at any stage of growth, but the symptoms frequently appear between the setting of the first and second trusses of fruit. The first symptom of the disease is a distinct narrowing and a slight crinkling of the young leaves (Figs. 1 and 2). As the infected plants grow, the leaf symptoms become more pronounced and, in severe cases, the leaves become much curled and distorted (Figs. 3 and 4). Leaves which are fully developed at the time of infection remain unchanged (Fig. 1). The upward growth of the infected plants is usually not greatly retarded, but the leaf area is reduced (Fig. 4), and the fruit is invariably smaller than the normal, inclined to be flattened, and of light weight. Sometimes growth is much retarded, and fruit fails to set on trusses formed after infection has taken place. Under favourable growing conditions instances of partial recovery associated with setting of fruit on the upper trusses have been reported from the field. This was also observed in the glasshouse.

Determination of Cause.

From a consideration of the symptoms and the rapidity of its spread in the field, it seemed probable that the disease was due to a virus. In order to test this an attempt was made to transmit the disease from infected to healthy plants by means of juice inoculations.

FIG. 1. NARROW-LEAF OF TOMATOES.

The plant on the left shows symptoms which are characteristic of the disease in the early stages of infection. Normal plant on right. Glasshouse-grown plants of the same age. [*Photo by H. Drake.*]

Experimental Method.

For the original inoculations, infected plants were secured from the field at Gisborne. In all subsequent experiments diseased material from the glasshouse was used. The leaves from an infected plant were ground in a mortar and the juice strained through muslin. Healthy plants, usually about 8 in. tall, were inoculated by rubbing

the leaves with muslin moistened with the above juice extract. This rubbing was sufficient to break the leaf hairs and to cause tiny scratches, thus allowing the juice to come in contact with the living tissue of the leaf. All plants were grown and all inoculations carried out in insect-free glasshouses. The variety of tomato used throughout the experiments was Sutton's Best of All.

FIG. 2. LEAF SYMPTOMS OF TOMATO NARROW-LEAF

Normal leaf on right. Leaves taken from glasshouse-grown plants.

[Photo by H. Drake.]

In Table I are given the results of the inoculations.

Table I.

Date of Inoculation.	Control. Number of Plants.	Control. Number infected.	Inoculations. Number of Plants.	Inoculations. Number infected.
31st March, 1933 ..	6	0	6	2
2nd March, 1933 ..	12	0	12	4
16th March, 1933 ..	6	0	6	6
7th April, 1933 ..	6	0	12	6
Totals ..	30	0	36	18

Incubation Period.

Narrow-leaf has no definite primary symptoms, and the development of narrow leaves takes place gradually. Although the plants were examined every second or third day, it was difficult to determine when the symptoms first became apparent. In one of the above four experiments definite symptoms were present on the thirteenth day after inoculation. In the other three experiments, however, although

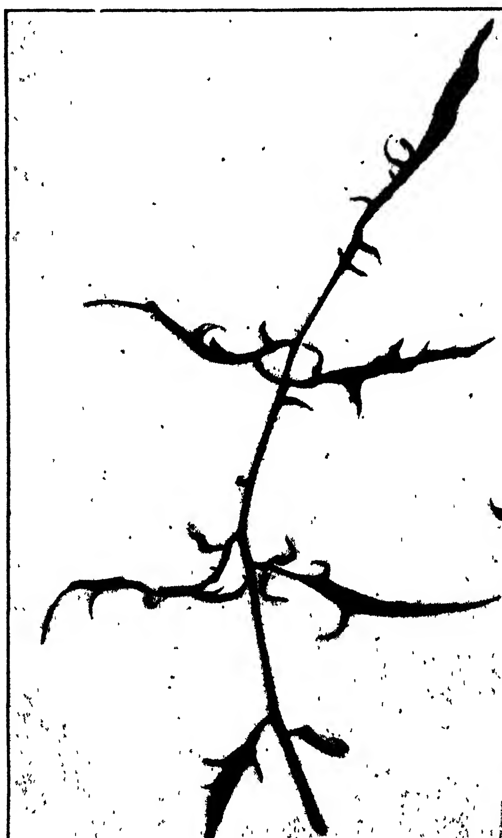

FIG. 3. TOMATO-LEAF SHOWING PRONOUNCED SYMPTOMS OF NARROW-LEAF.

[*Photo by H. Drake.*]

certain plants appeared to be slightly abnormal by about the fourteenth day, definite symptoms were not visible until eight to ten days later.

Transmission to Tobacco.

Of twelve healthy tobacco-plants inoculated with juice extract from narrow-leaf-infected tomato-plants, five became infected, while a similar number of check plants all remained healthy. The most characteristic symptoms of the disease on tobacco were a stunting of the plant and a

slight narrowing of the leaves (Fig. 5). The leaves of the infected plants were also slightly paler in colour than the normal, and the flowers, many of which failed to set seed, were distorted and showed pink-and-white stripes. Tomato-plants inoculated with juice from the infected tobacco-plants developed typical symptoms of the disease.

FIG. 4. NORMAL (LEFT) AND NARROW-LEAF TOMATO-PLANTS.
Plants of the same age grown in the glasshouse.
[Photo by H. Drake.]

TRANSMISSION BY APHIDES.

Healthy tomato-plants grown in 6 in. porous pots in an insect-free glasshouse were covered when 5 in. to 6 in. tall, with muslin cages as described by Cottier.* The aphides, bred on healthy *Solanum nigrum*

* Cottier, W. 1931: "The Transmission of Virus Diseases of Potatoes by Insects. Leaf-roll." *N.Z. Jour. Sci. & Tech.*, *13*, 85–95.

plants, were allowed to feed on infected plants for one week before they were removed to small squares of paper which were placed on the caged tomato-plants. The aphides soon migrated to the leaves of the healthy plants where they were allowed to feed for a given time before they were destroyed by fumigation with nicotine sulphate.

FIG. 5. NARROW-LEAF INFECTION OF TOBACCO-PLANTS.
Normal plant on right. Plants of the same age grown in the glasshouse.
[*Photo by H. Drake.*]

Inoculations with juice extract from each of the two plants infected through transmission by *M. pseudosolani* reproduced typical symptoms on healthy plants. Although the number of plants used in the experiments were not sufficient to give conclusive results, it was at least shown that the aphis *M. pseudosolani* is capable of carrying the disease.

The details of the experiments are given in the following table :—

Table II —Transmission of Narrow-leaf by Aphides.

Species of Aphis.*	Control.		Aphis Transmission			
	Number of Plants	Number infected.	Number of Days Aphides fed on Plants	Number of Aphides added per Plant.	Number of Plants	Number infected
Myzus persicæ ..	4	0	10	21	4	0
Myzus persicæ ..	4	0	24	24	4	0
Macrosiphum gei ..	4	0	19	10	4	0
Myzus pseudosolani	5	0	19	12–15	7	2

* The identification of the aphides used in these experiments was made by Mr. W Cottier, Assistant Entomologist, at this Station.

Remedial Treatment.

Control measures should be along the lines of those adopted for similar virus diseases.

Growers should raise their own seedlings.

All infected plants should be removed immediately the disease makes its appearance.

The hands should be washed thoroughly with soap and running water after handling infected plants and before working with healthy ones.

Summary.

(1) An apparently hitherto unrecorded disease of tomatoes has appeared in two districts of New Zealand.

(2) The most outstanding symptoms are : Narrowing and curling of the leaves, with subsequent reduction in leaf area. The fruit fails to set, and the yield is very much reduced.

(3) The disease, for which the name " narrow-leaf " is suggested, has occurred to the extent of 50 per cent. in some commercial gardens

(4) Successful transmission of the disease by artificial inoculations indicate that it is due to a virus.

(5) Experiments have shown that the aphis *Myzus pseudosolani* is a vector.

(6) The disease is also capable of infecting tobacco-plants.

Acknowledgments.

The writer wishes to acknowledge the help given by Mr. Everett, Orchard Instructor at Gisborne, who kindly supplied diseased material and from whose notes descriptions of field symptoms were largely drawn. Thanks are also due to Mr. Adamson, Orchard Instructor at Hastings, who forwarded diseased material from his district.

The potato crop (Aucklander Short Top, Dakota, Kerr's Pink, and Gamekeeper) grown on a salty area, Napier Village Settlement, has proved to be of splendid eating quality, being very floury when cooked. This is contrary to expectation, as an over-abundance of salt in the soil has been considered to cause soapiness and poor quality.

LINCOLN PURE-SEED STATION.

R. THOMSON, Assistant in Agronomy, Pure-seed Station, Lincoln.

THE objectives of the Station and its establishment have been detailed in a previous article (*Journal*, Nov., 1932.) It is unfortunate that a normal season has not been experienced since the work commenced. The winters of 1932 and 1933, the latter especially, were abnormally dry. These were in turn followed by dry spells in the spring and summer, resulting in checked growth, and only average, or below average, crops. Unseasonable frosts have been experienced, and the effect of these has been evident on the potato and the pea crops, and to a lesser extent on the wheat. The present winter has so far been very wet, and work has been delayed in consequence, but a good reserve of moisture in the subsoil for the coming summer is at least assured.

The rotation adopted originally—cereals, potatoes, peas, green-manure—has worked out very well in practice. Ample time is allowed for the thorough preparation of the land between each crop, and the beneficial effects of the green manure are already apparent in the better growth of the crops and the mellower nature of the soil when compared with the unmanured ground. Italian rye-grass has proved quite satisfactory for green manuring. With the object, however, of deriving the additional benefit of a legume, blue lupins, and a mixture of blue lupins and rye-grass, are being tested out.

One change worth recording concerns the subdivision of the farm. Previously it was divided into four areas of 11 acres and one of 8 acres. The whole farm has now been laid out in blocks of from 1 acre to 2 acres. Each block is worked on the four-course rotation, and the cropping is so planned that each area of wheat, potatoes, &c , is separated by at least three blocks from the nearest area of the same crop. As far as possible the policy of " one area one variety " is adopted. Although the system has been tried for only one season, its advantages have already been apparent. A strong north-west gale was experienced shortly after the peas were cut. Had all the varieties been growing side by side the result must have been the loss of the whole crop through mixing. With wheat the danger of stray straws being carried off the binder fans into an adjoining variety is removed, and by having the varieties so widely separated the danger of natural crossing is greatly reduced. In any crop there is now the possibility of checking the spread of disease should one variety, for some obscure reason, show an unexpected degree of infection.

The Canterbury Agricultural College authorities continue to co-operate in the matter of lending small isolation areas and in making available the use of plant and workshop facilities.

POTATOES.

The objective in view here is essentially the same as when the work commenced—viz., the isolation and multiplication of relatively virus-free lines. The spread of virus is still the major problem encountered in this work. In the previous article cited above reference was made to the appearance of odd severely infected plants, and it was suggested

that these were probably due to the transmission of disease from one variety to another. Subsequent observations have supported this view. The isolating as far as possible of one variety from another was carried out, and, although this has been practised only in two seasons, the number of badly diseased plants has been so greatly reduced as to indicate that the problem is well in hand. The system of separating widely each variety from its neighbour, as already mentioned, should prove a further step forward in respect to the control of the spread of virus trouble.

Some progress has been made in reducing the number of varieties. A number of doubtful merit have been discarded, but there still remain a dozen for which there is a demand for seed and which possess features that make them of value for specific situations. Much merit relatively

FIG. 1. SHOWING THE LAYOUT OF THE WHEAT-BREEDING PLOTS.

In centre, nursery-beds of single-plant selections, in foreground and distance, single-row multiplication plots surrounded by "bulk" of the same variety.

attaches to the old-established varieties such as Dakota and Aucklander Short Top for Canterbury, and Arran Chief and King Edward for further south. Arran Banner, of which much was expected after preliminary trials, has proved disappointing. This is in part due to the fact that it has been grown in many cases on heavy land on which it produces very coarse tubers, and in part to the fact that without sufficient attention to the seed stocks it degenerates rather rapidly. Arran Consul is a variety well worth further trial where a white-skinned, good-keeping potato is desired. All efforts to raise a healthy line of Up-to-date have failed, largely owing to its extreme susceptibility to stipple-streak. It is interesting to note that in New South Wales, where this variety, under the name of Factor, is one of the most popular, the disease is unknown.

With the additional shed accommodation it was possible last season to green and sprout the seed. The advantages were at once apparent in an earlier germination and a stronger and more even stand. An outstanding feature was that such bad cutting varieties as Aucklander Short Top and Majestic stood cutting remarkably well when greened and sprouted.

Problems of seasonal occurrence have been attacks of eelworm (*Heterodera marioni*) and potato-moth (*Phthorimaea operculella*). The former was extremely severe in 1931-32. Trials have been laid down to ascertain, if possible, information on conditions influencing the distribution and severity of the attack, but infection is so spasmodic as to render such work very difficult. In the meantime all the available information is being accumulated. The dry season and the dry open

FIG. 2. IRON DUKE POTATOES

nature of the ground in the summer of 1932-33 appeared to favour a heavy infestation of potato-moth. The pest may be checked by a deep mould, but in the season in question infected tubers were found 3 in. below the surface.

Seed has been distributed each season, orders being received from all parts of New Zealand. With most varieties the demand exceeds the supply. Samples are freely submitted for variety identification.

Wheat.

Work in building up and maintaining the main commercial varieties has been continued. The popularity of many of these is on the wane, and rightly so, since it has been shown that varieties like Tuscan and Hunters will give equal, if not better, yields under the same conditions.

Seed stocks are held and kept alive at the Station, and should a demand arise an area can be sown to meet requirements. What appears to be a superior line of Solid Straw Tuscan has been isolated, and trials are being carried out this season in the wheat-growing districts to determine its merits. Re-selection within Hunters II in an endeavour to obtain a more even line is proceeding. From the mass of material originally under observation seven lines now remain on trial. A limited, but nevertheless consistent, demand for seed of the Dreadnought variety comes from the Oamaru district. The Station selection of Dreadnought is steadily replacing the old strain on account of the superior yield of the former, and seed is distributed each season. Since the variety Jumbuck came into prominence, work has been commenced in building up a pure line. Owing to the very heterogenous nature of the original

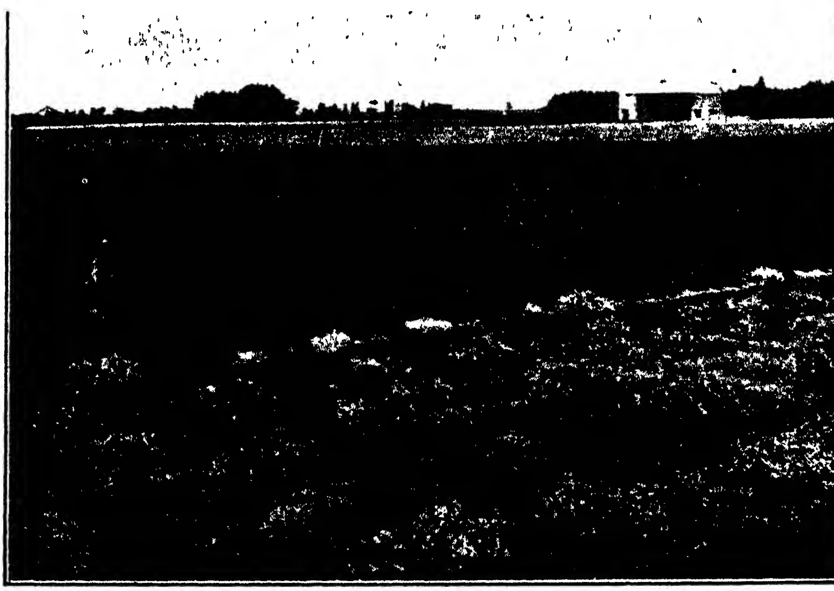

FIG. 3. SHOWING THE ROTATION.
In the foreground, peas; then potatoes; then wheat

material, only partial success has been attained up to the present. Some foundation material has been selected with a view to putting out a pure line of Cross 7 when the present seed becomes too impure.

Since all the nursery rows and propagation plots of any one variety have been grown within the bulk area of that variety the amount of natural crossing has been greatly reduced. By separating the varieties several chains from each other it is hoped to reduce such crossing to a negligible minimum.

To control loose smut the seed sown in the final "increase" blocks is hot-water treated, and a plant has been fitted up at the Station for the treatment of small lots. No details of its efficiency in controlling the smut are yet available, but the germination of treated samples appears to be very satisfactory.

Peas.

During the past season the work with garden peas reached the stage which has been the aim since its commencement in 1927–28—viz., the distribution to merchants for further growing in New Zealand of nucleus lines of seed. Twelve acres were sown with thirteen varieties, and all the seed except one small line was disposed of.

The occurrence of tare-leaved rogues presents the major problem in the work. The origin of these plants is obscure, but they occur and multiply despite the greatest care and attention. This season three varieties had to be discarded on this account. A definite project of the near future will be a study of the problem in an endeavour to ascertain the underlying causes, with a view to making selections, if possible, along other lines.

Other problems concerned the handling of the crop. Harrowing with light sharp harrows every four or five days, from the time of sowing until the peas were 6 in. high, was very effective in controlling weeds. Altering the mower so that additional tilt could be given to the knife allowed harvesting to be carried out without losing any pods.

The work with field peas received a set-back when it was found that the selections raised were very little, if any, better than commercial lines. Examination of past records suggested that the original range of materials was too narrow to hope for any outstanding variations. As a result, a new start has been made, and as wide a range of samples as was possible has been collected and grown for preliminary observation.

Linseed.

Owing to the press of other work, and also to the fact that under present market prices linseed has greatly waned in importance as a crop, this work has been restricted. Trials have been continued with the most promising local selections of the Moose variety and with imported lines. From the material on hand it should be possible to shortly put out an improved strain.

Oats.

Preliminary work covering the investigation and classifying of the varieties grown in New Zealand was carried out at the Plant Research Station. A detailed report of this work has recently been published in this *Journal* (May, 1934). Last season single plant selections of a number of varieties were received at Lincoln for trial under local conditions and for building up pure lines. The more important varieties will be increased as rapidly as possible. Others of less importance will be treated similarly to the wheat varieties—*i.e.*, seed stocks will be built up and held over until a demand arises. The outstanding feature of the work so far is the promise given by the variety Lampton, imported from New South Wales. Although a little coarse in the straw, this variety has given good yields of grain and chaff, and appears resistant to smut. Further material of similar breeding, along with seed of several other varieties, has been received from the New South Wales Department for trial this season.

Miscellaneous.

An area of 4½ acres was sown down last season with a strain of white clover raised by the Agrostologist. Although checked by the dry

season, this is now well established, and a seed crop should be harvested next summer. A small grass garden has been laid down, comprising typical strains of the grasses of chief importance economically.

With the object of producing nucleus stocks of pure lines of rape a number of strains raised at the Plant Research Station have been sown in nursery-beds, and will be transplanted in the spring.

Since the work started definite progress has been made. Seed is distributed regularly to farmers, and, as the resultant seed usually proves eligible for official certification, it becomes available to a much wider range of growers. Local problems concerning the handling of the various crops have been overcome, and the original objectives have become clarified, and, if not simpler, at least better understood.

THE FIBRE TYPES OF NEW ZEALAND ROMNEY SHEEP.

THE PRACTICAL BEARING OF PRESENT KNOWLEDGE.

F. W. DRY, Massey Agricultural College

IN recent articles there have been presented somewhat detailed accounts of the fibre types of the Romney lamb. These details it has all the time been the endeavour to interpret in terms of the forces at work in the growing fleece, but the practical bearing of the facts and ideas that have emerged has not been forgotten. If this story of the coat of the lamb was to be related at all, it had to be rather a complicated one in order to give the evidence for the conclusions drawn. The purpose now is to give a summary of the points which the breeder might keep at the back of his mind or in his mind.

THE VIEWPOINT OF THE RESEARCH.

First may be explained the viewpoint from which this research has been conducted. The work has practical aims, but these have in considerable measure been kept in the background Previous experience of research involving the breeding of sheep has been of less help than knowledge of the structure and growth of the hair of mammals gained in the study of the coats of small animals and from the published work of investigators who were often not concerned at all with wool. Stimulating ideas have also been seized upon from researches on the coats of sheep in other countries, especially those of Duerden and Fraser Roberts. Thus was it known for what kind of facts to search about the structure and development of the units of which the coat is composed.

The Early Detection of Fleece Characters.—While the knowledge gained may be counted upon to prove useful, directly or indirectly, in many practical ways, it should be explained at the outset how research associated with animal breeding may reasonably be expected to assist the breeder quickly. Some characters, it is true, such as horns, colour, colour patterns, or gross defects like the absence of teats or of external ears, are inherited in simple fashion, so that breeding on

Mendelian lines may give rapid, clear-cut results. Such features, however, rarely make the problems that engage the perennial attention of the breeder.

Most features of economic importance are not inherited in a simple manner. We are unable, for example, to detect separately the numerous genetic factors that determine fertility, milk-yield, or wool-count. All the same, selection in a desired direction is very largely effective. Down the ages selection has been the supreme instrument of the animal-breeder, and until the science of genetics, rapidly growing but youthful, has attained greater maturity one of the best services of the research worker will be to sharpen this powerful weapon, simply by aiding the discrimination of the breeder, thus making selection more certain, more accurate, or more rapid. This is the chief direction in which the study of Romney fibres is likely to find speedy application, in assisting the "measurement of excellence" in Crew's phrase, or the detection of faults, and in enabling us, moreover, to foretell in the early months or weeks of life the nature of the fleece at later ages.

Further Problems of Selection.--The methods of selection just mentioned may entail careful observation at a defined time, but there is no great subtlety in prophesying the hairiness of a later fleece from the hairiness at four months. In other problems of selection we seek to discover something that cannot be detected in so straightforward a manner.

There is a problem of this sort connected with kemp about which more is to be said later. We are able to say for lambs with no halo-hairs on the back at birth—and with no chance to grow kemp later—whether or not the growth of kemp would have been sustained had halo-hairs been present. From the point of view of breeding for the suppression of kemp some no-halo animals would therefore be better than others.

There is an unsolved problem of the kind under discussion in non-kemp hairiness. There is reason to believe that some lambs free from non-kemp hairiness have escaped hairiness by a safer margin than others, and are therefore more desirable for breeding. How to judge non-hairy animals from this point of view we do not yet know.

A Basis for other Researches.—The recognition of the different kinds of fibres composing the fleece supplies a necessary basis for extending our knowledge in a number of directions. We are better able to plan and interpret not only breeding experiments, but work upon the effects of differences in nutrition and in environmental conditions.

HAIRINESS.

Two Kinds of Hairiness.—Two kinds of hairiness are recognized, kemp and non-kemp. Kemps are fibres that grow for a definite, limited time, and are shed sooner or later after completing their growth. Belonging also to this first kind of hairiness are those hairy fibres that are not shed, but are of indeterminate growth, that are produced in follicles that have previously given rise to one or more kemps. Hairy fibres of the non-kemp group are those of indeterminate growth which are the first occupants of their follicles; secondly, in this group are also included fibres which are of very little importance

in a hogget fleece growing normally and which cease growing after a different time from kemps, and often in a recognizably different manner; thirdly, there are fibres which are presumed to succeed the last in the same follicles. It appears indeed not far from the truth to regard non-kemp fibres as growing indefinitely unless something in the nature of an accident befall them, whereas cessation of growth is an essential feature of a kemp.

In considerable measure the two kinds of hairiness vary independently, although there is some connection between the two, and this perhaps greater than has hitherto been thought. The lambs so far studied with the coarsest non-kemp hairiness on the back have all had halo-hairs abundant there; of no-halo lambs so far examined some have shown marked non-kemp hairiness, but such hairy fibres have not been very coarse. It would also appear a significant fact that in considerable measure the hairiness of persistent fibres succeeding birthcoat kemps in the same roots parallels that of the coarsest non-kemp fibres. This matter of the relation of kemp and non-kemp hairiness merits close investigation. It is important, nevertheless, to be on the lookout separately in the lamb's coat for the two kinds.

Recognition of Kemp Hairiness in the Lamb's Coat.—Large birth-coat kemps, or halo-hairs, project above the rest of the coat at birth, and may still be recognized very readily at docking-time. It has been suggested that selection against these should be as keen as is practicable, with attention paid especially to the back and britch.

There are great differences between lambs in the hairiness of the fibres which follow the shed halo-hairs in the same roots. Some understanding has been attained of how these differences come about, as has recently been reported in a preliminary account. The fibres succeeding halo-hairs are most objectionable when they are kemps—and a series of kemps may follow one another in the same follicle—or grossly hairy fibres of persistent growth. On the other hand, where there is little or no non-kemp hairiness, it can come about, in certain definite conditions, that the hairiness of the successors of halo-hairs is slight, or negligible, or perhaps even zero.

It is conceivable that in some breeding projects it might be a commendable policy to breed for freedom from hairiness in the successors of halo-hairs rather than to select against halo-hairs themselves, and in such a situation the facts that have lately come to light would be useful. In the Romney selection against halo-hairs is simpler.

At the present stage of our fight against hairiness it is hardly necessary to select separately against the slimmer birth-coat kemps—mostly sickle-fibres—that finish growing about the same time as halo-hairs. Very largely these fibres will be detected in benzol-testing at times appropriate for judging non-kemp hairiness.

It will be recalled that hairy sickle-fibres may or may not be shed, and that they are shed in very varying proportions, though it is unlikely that all such shed fibres would be lost from the coat. If halo-hairs are present on the back in more than the paltriest numbers, then we know that sickle-fibres (all hairy, or some hairy and some fine after birth in different fibre-type arrays) are plentiful. In many lambs with no halo-hairs on the back there are none of the slimmer birthcoat

kemps, but they may be plentiful, so that it may eventually prove worth while to keep a watch for these fibres in no-halo lambs by benzol-testing at about ten weeks.

If the abundance of halo-hairs had not been noted before they fell out, it would be well to keep a watch later on, if specimens were examined in benzol, for possible very hairy successors which begin to grow about the third or fourth months and which may therefore be very prominent in benzol in a six months' sample.

Recognition of Non-kemp Hairiness in the Lamb's Coat.—Assuming the lamb to be growing normally, if non-kemp hairiness is going to make its appearance it can be recognized, in fibres which mostly appear entirely innocent when the lamb is born, when growth has continued for a very short time after birth. Generally this hairiness is in evidence in the first few days of life, but if we allow three weeks in a lamb that is developing reasonably well, and then find no non-kemp hairiness, we may accept any such portions of the fleece as free for the first year, and, in all probability, though experience here is limited, in later fleeces.

On present knowledge we are not able to foretell how far down the staple hairiness will be sustained. We can only wait and see. The age of two months, as will be more apparent directly, is an important date. It is about this time that any sickle-fibres and allied types that are to be shed have finished their growth. This level is called the crisis level, for it is a critical time in the career of such fibres, which may or may not be shed. A hairy fibre that persists may go suddenly thin at this point, often recovering its coarseness, after being thin for half an inch or a little more, instead of shedding. If non-kemp hairiness ceases definitely above the crisis level, then this hairiness has not been found to be renewed before shearing-time when the animals are a little more than a year old. If non-kemp hairiness should cease at or below that level there may, or may not, be a revival of hairiness at some time later in the growth of the first fleece.

Relation in Kemp Hairiness between the Fleeces of the First and Later Years.—There is substantial evidence that kemps grow later in the first fleece only when birthcoat kemps are present, and in the extensive material studied any kemp that can have grown later—"secondary kemp," so-called—in the follicles of anything but the biggest birthcoat kemps—that is, the halo-hairs- has rarely amounted to anything.

Similarly, kemp has been found in later fleeces only when secondary kemp has grown in the first fleece. Sometimes an animal with much secondary kemp in the first fleece has continued to grow plentiful kemp in subsequent years. Sometimes kemp has become clearly less plentiful in later fleeces, presumably because kemp follicles have changed over to producing fibres of persistent growth. Whether such follicles, after sustaining the growth of one fibre for a long time, can halt again and revert to putting forth kemps, which grow for something like a couple of months only, has not been determined.

Persistent fibres succeeding halo-hairs are often outstandingly objectionable hairy fibres in the first fleece, and it is probable that they are similarly prominent in later fleeces. Individual fibres have not yet been followed through from one fleece to another, but at the revival of hairiness following suspension of medulla formation in the winter these persistent occupants of kemp follicles have been conspicuous for early restoration of medulla and for coarseness.

Relation in Non-kemp Hairiness between the Fleeces of the First and Later Years.—Preliminary studies have been made by examination by eye of specimens in benzol from a standard position on the side, this being the region from which specimens have most consistently been preserved. The indication is, apart from an exception to be discussed directly, that the abundance of hairy fibres of the non-kemp group is much the same in each of the first four fleeces. It is to be noted that the later fleeces may be the coarser, and their hairiness more readily detected by eye, and medulla may be better sustained towards the butt of the staple. This is probably the explanation of the statement by breeders that the third fleece may be badly hairy after the animal has been thought good enough on the first two fleeces. If we may generalize from the observations now under consideration, examination in benzol reveals the true situation in the two first fleeces where, as has happened to me, it has not been realized from inspection how hairy they were.

When medulla on the back or side in the first year's fleece does not extend below the crisis level, then in the same part of the next fleece there may be less medulla or none at all, and then the third fleece also has been free. The reduction may be greater on the back than on the side. Parallel results are recorded by Mr Rudall from studies of the effects of shearing lambs at about three months and a half.

How now are we to regard the position just stated? There are alternative viewpoints. On the one hand, we may be lenient to such animals, and make allowance for early error in a lamb which in after-life mends its ways. From the practical standpoint this is probably the right attitude in flocks where quite a measure of hairiness must be permitted in order to retain enough breeding-stock. On the other hand, we may regard this touch of hairiness in the early days as revealing the unsatisfactory hereditary endowment of an animal which would show up splendidly on the benzol-testing of later fleeces. More will be said on this point shortly. This second attitude may well prove the ideal one to adopt in judging rams.

Inheritance of Kemp Hairiness.—The abundance of halo-hairs is strongly inherited. Selection for many halo-hairs on the back, or for freedom from halo-hairs there, has proved largely effective, and especially, so far as the experiments have gone, has the selection of animals entirely free from halo-hairs on the back. At the same time, offspring may have fewer halo-hairs than their parents, and parents both with moderate numbers of halo-hairs, or even both with few halo-hairs (1934 season), have produced lambs with many halo-hairs.

With regard to the successors of halo-hairs, a lamb is to be reported with many of these successors kemps, and with kemp continuing to be grown later in the first fleece, whose parents both had few kemps amongst the successors of halo-hairs. Again, it is to be emphasized that the way to avoid complications in kemp hairiness, interesting though they be from physiological and genetical points of view, is to select hard against birthcoat kemp.

Inheritance of Non-kemp Hairiness.—Here the experiments performed have been of but a rough sort, but, as breeders will readily believe, they point to the great importance of inherited factors. Some lambs were more hairy than either parent, a fact which again will cause no astonishment.

Non-genetic Factors and Hairiness.—In simple shearing experiments (R. Waters, K. M. Rudall, and myself) in which an animal has been treated differently on parts of the body which could fairly be compared, differences in hairiness have been produced. The probable explanation is that when the skin is kept warm this tends to less hairiness, while the response of the skin to cold tends to more hairiness. Here we see the influence of physical conditions.

In these shearing experiments it has been found how delicate is the balance which determines whether wool be hairy or not. By leaving 1½ in. of wool, instead of shearing close in the ordinary way, hairiness has largely been suppressed in slightly hairy animals Again, for example, Mr. Rudall has shown the effects of shearing sometimes to extend a little way into the adjacent unshorn area, gradually tailing off there; and the converse also happens. The significance of details like these for the fundamentals of our fight against hairiness will be discussed directly. Here may be expressed my personal preference, in the light of the facts just reported, for attaching in selection proportionately more importance to variations in the hairiness in the tip of the staple grown just after shearing, when conditions are generally the most favourable for medulla formation, than to variations in the distance down the staple to which hairiness extends.

Nutrition also has its effect on hairiness, in that a number of slightly hairy lambs growing poorly showed temporary reduction in non-kemp hairiness and in fibre diameter at growth stages at which comparable lambs show no such reduction The temporary reduction occurred about the time when the lambs were growing exceptionally badly, in some of their early weeks, reappearing in the wool grown afterwards when they were making better progress. These facts are consistent with the view, for which there is a variety of other evidence, that hairiness is an expression of vigorous wool growth. With many animals, it is clear, good conditions tend to greater hairiness, poor conditions to less Often little or no medulla is produced in the winter season when the staple is hairy at other levels. Hunger-fineness, however, is a poor escape from hairiness.

At the same time, the possibility is borne in mind that good conditions may produce a different effect. When hairiness is attributed to the vigour of the fibre root, this is thought to be putting out material faster than it can keratinize this fibre stuff to form the substance of pure wool. If any condition should improve the keratinizing-power of the root proportionately more than it increases the output of material, then this condition would reduce hairiness. Such a state of affairs we must be not unprepared to encounter.

The facts just reported serve to emphasize the need for investigating the effect upon hairiness of nutritional and other non-genetic factors. Such knowledge would find immediate application as an aid in judging the hairiness of animals in the selection of breeding-stock. The question of hairiness in relation to fleece-weight is, besides, by no means unimportant.

Probable Differences in Non-hairy Wools.—Mention has been made of the well-known fact that a staple may be hairy at one level and pure wool at another. It is one thing to grow pure wool in the

winter, and another thing to grow pure wool just after shearing. It will be recalled, too, that of sheep free from non-kemp hairiness in the second year some were free in the same part of the fleece in the first year, while others were somewhat hairy in their first two months. It has been explained, also, how little will sometimes tip the balance between the presence and absence of medulla.

Facts like these point to differences in pure wool in the margin by which hairiness is escaped, to differences, most likely, in keratinizing-power. Especially with fine-wooled sheep is it likely that many pure-wooled animals are not hairy precisely because the wool is fine, and that if those sheep had coarser wool, with the rest of the hereditary make-up the same, they would be hairy. If this be so, we could readily understand the appearance of hairiness, as it is stated by breeders to come to light as the result of crosses between coarse non-hairy and fine non-hairy animals. If real differences exist in what may be termed the margin of safety against hairiness, it would be highly useful to be able to detect them, for then the effectiveness of selection against hairiness would be markedly increased.

There are a number of possible avenues of attack on this problem, and mention may be made of researches that have bearing upon it. Sidey has reported differences in the sulphur content of non-hairy New Zealand wools. The Wool Industries Research Association and Sidey have shown that desirability for spinning and high sulphur content are accompanied by good circularity of cross-section. Rudall, on pulling out fibres, finds differences, between lambs that had not been hairy on the part of the body experimented upon, in the hairiness of the fibres growing afterwards in the roots from which the original occupants had been torn. Gabriel has made studies of the size and shape of the cortical cells of wools of widely contrasted breeds. The determination of the inherent tendency to hairiness of a non-hairy animal is a major problem.

Other Problems.

It has been usual to state the practical bearing of the study of the fibre types almost exclusively in terms of hairiness Our friends in Britain connected with manufacturing have also much to say about evenness between fibre and fibre in length and diameter, features which are inter-connected, and evenness in diameter along the length of the same fibre. To a large extent these features are associated with differences in hairiness, and it may be pointed out without elaboration that knowledge of fibre types and fibre-type arrays is as fundamental in relation to these features about which little has hitherto been said as it is to hairiness. There are indications of differences, irrespective of hairiness, in evenness of length and diameter, and here, too, it is probable that the examination fibre by fibre of wool specimens taken at the age of two to three months will prove important. Evenness over the body in respect of these dimensional features of fibres also calls for attention, and here recent work by Miss Galpin is pertinent. She has found marked variation from animal to animal in the change over the body of the fibre-type array.

In connection with "untrueness," or unevenness in diameter along the fibre, reference may be made to the work of Mr. Waters upon growth-rate at different times of the year. In some hoggets he found an

astonishing reduction in growth-rate in length in the winter, accompanied by great reduction in diameter. Mr. Waters stresses the differences in animals of the same flock in their ability to sustain wool output in unfavourable conditions. The view that these differences between animals are in part inborn is also made probable by the varying evenness in growth-rate throughout the year reported in investigations in other countries.

The point just touched upon introduces the large question of fleece-weight. Here, again, knowledge of the times and modes of development of the different kinds of fibres composing the coat provides working capital for research upon the factors determining the weight of the fleece, or, perhaps more important, as Fraser Roberts has pointed out, the weight of wool produced in a given time by a unit area of skin.

In lambs growing badly in the early weeks of life it has been found that far fewer new fibres than normal start to grow during the time of poor progress. It is a matter for investigation whether the effects of this check to the development of the coat are ever made good. One also wonders whether anything could be done to initiate the growth of a greater number of fibre-roots early in the life of the lamb, or even before birth, when the foundation of the fleece is being laid, which might have a lasting influence upon fleece-weight.

Sidey has drawn our attention to the surprisingly large differences in the fleece-weights of animals of the same stud flock. Fleece-weight, therefore, is an important matter for investigation There is, besides, a pleasing contrast, after contemplating attempts to correct defective features, in seeking to produce a larger quantity of wool that is already good.

SUMMARY.

The most immediate practical aim of the work discussed is to aid in selection for wool characters, and especially to save time by making it possible to distinguish between good and bad when sheep are very young.

In judging the coat of an animal in a work-a-day world observations that can be made in the yards or wool-shed will be employed wherever possible. It is expected, however, that it will become desirable in practical breeding sometimes to sort out the individual fibres of a specimen against a black background. Such work might be the employment of professional sorters of wool on the minute scale, but it would be perfectly possible for the breeder to carry it out himself.

Two kinds of hairiness are recognized: kemp and non-kemp. These two kinds are not wholly independent, but it is necessary to select against them separately.

Large birthcoat kemps, or halo-hairs, may be recognized at a glance at birth or at docking-time.

From the practical point of view it is only when halo-hairs are present in a portion of the fleece that kemp is of consequence in that region later.

Halo-hairs on falling out are often succeeded in the same roots by secondary kemps and by very coarse hairy fibres of persistent growth.

A series of breeding experiments has shown that the abundance of halo-hairs is strongly inherited. Selection for complete freedom from halo-hairs on the back has been largely effective.

It is suggested that selection against halo-hairs should be as keen as is practicable, with attention paid especially to the back and britch.

If the abundance of halo-hairs has not been noted before they fall out, a lookout may be kept, when examining specimens in benzol at six months or later, for hairy fibres not reaching the tip of the staple that may be succeeding halo-hairs in the same roots.

In lambs growing normally non-kemp hairiness makes its appearance, as the coat continues its growth after birth, in the very early days of the animal's life. Lambs free at three weeks may be accepted as entirely desirable on this count.

When non-kemp hairiness is at all well sustained down the staple in the lamb's coat, it is indicated by preliminary studies that the abundance of hairy fibres is much the same in each of the first four fleeces.

The statement by breeders that the third fleece may be badly hairy after the animal has been deemed acceptable on the first two fleeces is probably to be explained by greater coarseness of the non-kemp hairy fibres of the third fleece, with the state of affairs in the earlier fleeces open to detection in benzol even though it be not recognized by eye.

When non-kemp hairiness on the back and side in the first year's fleece is not sustained for more than about two months, then in the same part of the next fleece there may be less hairiness, or none at all, and then the third fleece also has been free.

Towards the animals just described one will be lenient in flocks in which it is not feasible to adopt an exacting standard.

When the standard is more rigid one would prefer an animal, especially a ram, to be free from hairiness not only in later fleeces, but in that of the first year

Experiments of a rough kind point to the great importance of inherited factors in determining non-kemp hairiness. In these experiments some lambs were more hairy than either parent These findings are in line with the experience of breeders

Non-kemp hairiness is affected by physical conditions and by nutrition. In the work described greater hairiness has tended to accompany vigorous growth of the fleece.

Lambs thriving badly have been less hairy than they would have been had they made better progress.

It is suggested that it is best to judge the hairiness of an animal on wool grown when conditions are most favourable to the production of medulla, and that, in sheep that have been shorn, is usually just after shearing.

The balance between slight hairiness and freedom from medulla is easily tipped by non-genetic factors. On this and other grounds non-hairy wools are believed to differ in the margin by which they escape hairiness. For preventing hairiness in his offspring one non-hairy ram may be expected to be better than another. To discover the means of judging non-hairy wools from this point of view is regarded as a major problem.

Without discussing the matter exhaustively, enough has been said, following earlier articles, to emphasize the significance of features of the coat in the early days and months of life. The importance of detailed knowledge about the coat of the young lamb is the chief point to which it is desired to give prominence.

DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF THE 1933-34 SEASON.

W. M. SINGLETON, Director of the Dairy Division, Department of Agriculture, Wellington

IT is just twenty-five years since the introduction of systematic herd-testing to New Zealand, and it is interesting to review the progress of the movement in that brief quarter of a century. In August, 1909, New Zealand's first cow-testing association commenced operations. This was in the Wairarapa district. The work was organized and carried out by the Dairy Division in co-operation with the Dalefield Dairy Co. and a number of its suppliers, 815 cows being tested. During the following season the testing was continued at Dalefield and extended to Cambridge, Stratford, and Kaupokonui. The third season, 1911-12, saw two further associations in operation, these being at Whangarei in the North and Stirling in the South. Woodville, Kairanga, and Tai Tapu came in in 1912-13, and by 1918-19 the dairying districts of the Dominion were fairly well catered for, as, in addition to the localities already named, there were cow-testing associations at Cheltenham, Konini, Riverbank, Te Rehunga, Ngaire, and Hawera. These various organizations were conducted by the Dairy Division and were regarded as "illustration" associations. It was hoped that they would illustrate to dairy-farmers the method of conducting the work and the benefits to be obtained from the information relating to yield provided by the returns with which the member was supplied, both monthly and at the end of the season. Although now almost entirely superseded by the "Group" system, the "Association" system rendered a great service to dairy-farmers, and on account of its simplicity and low cost succeeded in establishing herd-testing where a more elaborate and expensive method might easily have failed.

THE GROUP TEST.

By 1914 15 the number of cows tested during the season had reached the 25,000 mark. Thereafter for a year or two the numbers declined, due partly to shortage of labour on the farms and partly to concentration on the tremendously increased output of dairy-produce, both factors being the direct result of the Great War. There were, however, other important influences, the principal one being the rapidly increasing usage of the milking-machine. The adoption of mechanical milking complicated the taking of milk weights and samples, and it became apparent that future progress in herd-testing depended upon taking the work out of the dairy-farmers' hands. The years 1920 to 1922 witnessed a revival of interest in herd-testing, and the number of tested cows rose from 17,000 in 1918-19 to 45,500 in 1921-22. Although the Government was still conducting a large number of associations, its policy was to withdraw as rapidly as practicable in favour of private enterprise.

The start of a revival came with the introduction of the Group system in the Waikato in 1922. The development of the system is obvious from the fact that last season nearly 300,000 cows were tested systematically in this Dominion, and that almost 92 per cent. of these

were tested by the Group method. The Group herd-testing operations in New Zealand have been developed into a thoroughly organized movement, and practically every Group organization is now registered under the Incorporated Societies Act, while the various groups are in turn federated with the Dominion Group Herd-testing Federation (Incorporated). This organization was established primarily to standardize or assist in standardizing Group herd-testing methods throughout New Zealand, and also to extend the work. Membership of the federation is confined to Group herd-testing associations registered under the Incorporated Societies Act. The expenses of the federation are met by a levy on all cows tested by federated groups. This organization employs Mr C. M. Hume as Federation Supervisor of Herd-testing, and his principal duties are to supervise the Group herd-testing movement, with a view to standardizing practice, increasing efficiency, effecting economy where possible, and, where possible, assisting to extend the membership His salary and expenses are defrayed partly by the Government and partly by the federation.

Government Subsidy to Herd-testing.

Since 1927 the Government has given an annual subsidy to testing dairy-herd owners and by way of assistance in establishing new organizations and extending the movement The largest amount granted in any one year was £10,500, the smallest—that for last season's testing—£5,000. In 1932 the New Zealand Dairy-produce Control Board also gave a grant of £6,000 to herd-testing.

It will be apparent that the Government has rendered considerable assistance to herd-testing, both by way of education and fostering the work as well as by financial aid, and it is safe to say that herd-testing would not have been so firmly entrenched to-day without that Government financial aid and sympathetic support.

New Zealand Herd-testing Central Executive.

In 1929 the New Zealand Herd-testing Central Executive was formed, principally for the purpose of allocating Government subsidies to herd-testing and supervising the movement generally. This body comprises nine members and a secretary. The representation is as follows. The Dominion Group Herd-testing Federation, four members, one of whom acts as Chairman; the New Zealand Dairy-produce Control Board, one member; the Dairy Research Institute, one member, the New Zealand Dairy Breeds Federation, one member; the Department of Agriculture, two members. The secretary is an officer of the Dairy Division, Department of Agriculture.

Development of Herd-testing.

Prior to the foundation of the Dominion Group Herd-testing Federation, herd-testing was not organized, inasmuch as there was no co-ordination between the various associations With the introduction of the Group system commenced the decline of the Association system and the really rapid progress of the movement.

Table 1 provides a general summary of the herd-testing movement since its inception from the point of view of average production and number of cows tested. For purposes of comparison, figures have

been included regarding New Zealand's total dairy-cow population and the estimated average butterfat-production for all cows in milk and dry.

Table 1.

Season.		Cows in Milk and Dry.		Number of Cows in Milk.	Tested Cows.		Percentage of Tested Cows to Cows in Milk.
		Number.	Average Yield of Fat.		Number.	Average Yield of Fat.	
			lb.			lb	
1909–10	..	583,163*	148·45	..	815	..	..
1910–11	..	633,733	139·46	..	4,317	..	..
1911–12	..	655,503*	140·10	..	13,440	..	..
1912–13	..	678,021*	150·78	..	25,000	..	..
1913–14	..	701,312*	156·52	..	25,000	..	..
1914–15	..	725,403*	154·07	..	24,000	..	..
1915–16	..	750,323	160·52	..	24,105	..	..
1916–17	.	777,439	163·96	684,032	14,343	..	2·0
1917–18	..	793,215	152·23	710,561	26,768	..	3·7
1918–19	..	826,135	150·64	732,253	17,000	..	2·3
1919–20	..	893,454	152·04	782,757	25,134	230·25†	3·2
1920–21	..	1,004,666	154·25	890,220	35,757	210·92†	4 0
1921–22	..	1,137,055	174·97	1,015,325	45,564	232·99†	4·5
1922–23	..	1,248,643	180·62	1,124,671	84,825	233 82	7·5
1923–24	..	1,312,589	174·10	1,184,977	151,214	212·75	12·7
1924–25	..	1,323,432	182·09	1,195,567	196,850	223·54	16·4
1925–26	..	1,303,856	179·40	1,181,441	169,776	220·51	14·4
1926–27	..	1,303,225	198·50	1,181,545	170,150	240·48	14·4
1927–28	..	1,352,398	195 38	1,242,729	224,130	224·68	18·0
1928–29	.	1,371,063	210·84	1,291,204	259,594	240·50	20·1
1929–30	..	1,440,321	218·05	1,388,872	283,731	253·61	20·4
1930–31	..	1,601,633	201·04	1 499,532	271,404	241·05	18·0
1931–32	..	1,702,070	199·65	1,582,604	259,857	236·87	16·4
1932–33	..	1,845,972	215·10	1,723,913	286,054	255·57	16·6
1933–34	..	1,932,511	220·80	1,816,402	297,647	262·44	16·4

* Geometric mean. † Associations conducted by the Dairy Division.

The figures in Table 1 help us to realize the progress which has been made not only in cow-testing, but in dairy-production as a whole. In 1909–10 our dairy-cow population was 583,163, whereas in 1933–34 it was 1,932,531, while in total butterfat-production the figures were 86,572,741 lb. and 426,699,242 lb. respectively, an increase of nearly 500 per cent. Another interesting feature is the rapidly decreasing number of dry cows in proportion to total cows. From another point of view the table indicates the progress which has been made *through* herd-testing as well as *in* herd-testing, and it is safe to say that our present position regarding average butterfat-production and consequently total butterfat-production would not have been nearly so favourable without the good influence of herd-testing. The position regarding percentage of cows tested is not quite so favourable as that regarding number of cows tested, but in view of the severity of the depression we should be satisfied with having avoided a further decrease from the peak year of 1929–30.

Separate figures for average production under Group and Association Own-sample systems are available only for ten years back. These are given in Table 2, and afford an interesting comparison, the decline of the original Association system being obvious. A gratifying position is the marked increase in average lactation period, which, it will be noted, is much more apparent in the case of the Group system, methodical practice having exerted a favourable influence.

Table 2.

Season.	Group Herd-testing.			Association's Own Sample.		
	Cows.	Average Fat.	Average Days.	Cows.	Average Fat.	Average Days.
		lb.			lb	
1924–25 ..	82,961	222·54	235	68,914	224·75	221
1925–26 ..	97,575	223·06	236	48,823	215·40	217
1926–27 ..	108,150	243·88	241	46,878	232·64	220
1927–28 ..	158,734	228·46	237	47,589	212·07	204
1928–29 ..	206,089	241·69	246	39,722	234·33	222
1929–30 ..	236,941	254·32	251	35,613	248·88	223
1930–31 ..	234,799	241·50	250	25,670	236·90	225
1931–32 ..	229,606	238·11	256	21,835	223·79	229
1932–33 ..	253,016	256·86	259	23,163	241·46	232
1933–34 ..	206,481	264·10	257	20,408	240·79	230

As a result of our herd-testing movement, combined with the Certificate-of-Record and Government Official Herd-testing, we are steadily accumulating a large mass of information regarding the productive ability of our dairy cows. Such information is invaluable as a basis for herd-building, herd-management, and improved dairy-farming methods.

Results for 1933–34.

During the past season a peak was reached for both number of cows tested and average production of tested cows. Some 297,647 cows were tested, representing an increase of 11,593 cows, or 4·05 per cent., over the 1932–33 total of 286,054. The average butterfat-production per tested cow was 262·44 lb., an increase of 6·87 lb. fat over the previous season's average of 255·57 lb. An item worthy of special mention relates to the achievement of an average of over 300 lb. fat per cow by the South Taranaki Herd-testing Association. Their returns for last season were 309·89 lb. fat per cow in 282 days for 8,087 cows This was the first occasion on which an organization has succeeded in reaching the objective set by the Dominion Group Herd-testing Federation some years ago.

Table 3 provides statistics relating to dairy cows in milk and dry, and covering the past ten years.

Table 3.—Dairy Cows in Milk and Dry as at 31st January of each Year

Season.	Total Cows.	Cows in Milk.	Dry Cows	Percentage of Dry Cows to Total.
1924–25	1,323,432	1,195,567	127,865	9·7
1925–26	1,303,856	1,181,441	122,415	9·4
1926–27	1,303,225	1,181,545	121,680	9·3
1927–28	1,352,398	1,242,729	109,669	8·1
1928–29	1,371,063	1,291,204	79,859	5·8
1929–30	1,441,410	1,389,541	51,869	3·6
1930–31	1,601,633	1,499,532	102,101	6·4
1931–32	1,702,070	1,582,664	119,406	7·0
1932–33	1,845,972	1,723,913	122,059	6·6
1933–34	1,932,511	1,816,402	116,109	6·0

A numerical classification of tested cows according to land district is given in Table 4. It will be noted that the tested cows represent 16·4 per cent. of our total cows in milk, and that, while the total number of tested cows continues to increase, we are barely holding our own from the point of view of percentage tested.

Table 4.—Numbers of Cows tested Twice or more, and Percentages of Total Cows in Milk, classified according to Land Districts.

Land District.	1929–30.		1930–31.		1931–32.		1932–33.		1933–34.	
	Cows tested	Percentage of Total Cows in Milk	Cows tested	Percentage of Total Cows in Milk	Cows tested	Percentage of Total Cows in Milk	Cows tested	Percentage of Total Cows in Milk.	Cows tested.	Percentage of Total Cows in Milk.
North Auckland ..	58,113	24·5	55,283	20·9	56,091	19·6	59,408	18·8	55,801	16·4
Auckland ..	109,811	26·8	102,534	22·6	99,806	20·6	111,517	21·1	120,982	21·3
Gisborne ..	12,329	33·4	10,418	25·0	9,145	20·4	10,634	19·9	12,460	21·8
Hawke's Bay ..	8,505	17·0	8,742	16·7	4,933	9·2	5,910	10·3	5,581	8·9
Taranaki ..	31,693	15·1	32,519	14·7	31,179	13·8	32,302	13·6	38,878	15·7
Wellington ..	42,224	21·1	35,875	16·7	30,569	13·6	34,992	14·6	38,290	15·2
North Island ..	262,675	23·0	245,371	19·7	231,723	17·6	254,763	17·8	271,992	17·8
Nelson ..	2,128	8·0	5,732	20·9	6,637	23·7	7,430	23·8	4,445	13·6
Marlborough ..	3,628	23·7	3,064	19·2	2,647	16·2	2,334	13·6	2,067	11·9
Westland ..	..	..	2,380	18·8	5,030	39·6	2,844	20·4	2,801	19·2
Canterbury ..	2,816	3·8	3,244	4·3	2,344	3·1	4,359	5·4	4,957	6·0
Otago ..	2,975	5·7	3,775	7·0	4,480	7·9	4,800	7·9	3,752	6·1
Southland ..	9,509	13·7	7,838	10·9	6,996	9·4	9,524	11·7	7,633	9·3
South Island ..	21,056	8·5	26,033	10·2	28,134	10·6	31,291	11·0	25,655	8·8
Dominion ..	283,731	20·4	271,404	18·0	259,857	16·4	286,054	16·5	297,647	16·4

NOTE.—"Total Cows in Milk" is at 31st January in each year.

Table 5 is a summary indicating the number and size of the various organizations. An "organization" denotes an individual unit—that is to say, a Group herd-testing association operating ten groups would be included as ten, not one.

Table 5.—Number of Cows, Herds, and Organizations represented in Season's Summaries received (Basis: All Cows in Milk 100 Days or over.)

	1931–32.	1932–33.	1933–34.
Group Testing			
Number of groups	197	200	213
Number of herds	4,772	5,090	5,120
Number of cows	229,606	253,016	266,481
Average number of herds per group	24	25	24
Average number of cows per herd	48	50	52
Average number of cows per group	1,166	1,265	1,251
Association Testing			
Number of associations	81	78	73
Number of herds	1,213	1,242	1,105
Number of cows	21,835	23,163	20,408
Average number of herds per association ..	15	16	15
Average number of cows per herd	18	19	18
Average number of cows per association ..	270	297	280

Table 6 is a general production summary. Figures for 6,225 herds were surveyed for the compilation of this table, of which 5,120 were tested under the Group system and the remaining 1,105 under the Association Own-sample test. The corresponding figures for 1932–33 were 6,332 herds—5,090 Group and 1,242 Association.

Table 6.—Grand Summary of all Herd-testing Results on the Basis of all Cows in Milk 100 Days or over received for the Last Two Seasons.

	1932–33.			1933–34.		
	Number of Cows.	Days in Milk.	Butterfat-production.	Number of Cows.	Days in Milk.	Butterfat-production.
			lb.			lb.
Average for all cows	276,179	257	255.57	286,889	255	262.44
Average for all Group cows	253,016	259	256.86	266,481	257	264.10
Average for all Association cows	23,163	232	241.46	20,408	230	240.79
Highest Group average	403	260	318.01	204	282	334.25
Lowest Group average	688	249	201.23	1,022	225	194.00
Highest Association average	43	262	335.70	108	264	337.90
Lowest Association average	48	181	152.71	100	208	178.91
Highest Group herd	6	290	465.67	15	305	551.00
Lowest Group herd	3	128	71.33	24	192	88.00
Highest Association herd	31	315	488.15	4	312	435.07
Lowest Association herd .	3	113	57.32	22	126	92.00
Highest Group cow .. .		300	703.49		261	879.00
Highest Association cow	..	245	645.00	.	294	775.00
Average daily production of butterfat for all Group cows	..	.	0.99	.	.	1.03
Average daily production of butterfat for all Association cows.	..	.	1.04	..	..	1.05

In Table 7 average butterfat-production is classified according to and districts.

Table 7.—Average Production, according to Land Districts, of all Cows under Herd-test for which Seasons' Summaries were obtained.
(Basis : 100 Days or over.)

Land District.	1930–31.			1931–32.			1932–33.			1933–34.		
	Cows in Summary.	Average Days in Milk.	Average Butterfat	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary	Average Days in Milk.	Average Butterfat.
			lb.			lb.			lb.			lb.
North Auckland	53,158	243	218·16	54,101	253	229·56	57,771	255	245·53	54,007	250	241·11
Auckland	99,042	253	243·95	97,218	260	233·61	108,504	264	254·67	116,769	260	262·09
Gisborne	9,899	235	225·13	8,853	250	242·29	10,265	251	254·73	11,967	251	247·50
Hawke's Bay	8,324	227	219·28	4,808	253	246·71	5,595	255	263·01	5,389	253	258·75
Taranaki	31,633	259	268·40	29,960	257	256·41	31,686	265	270·19	37,790	264	286·32
Wellington	34,152	248	252·29	29,215	244	226·03	32,012	253	255·61	36,491	255	275·64
North Island ..	236,208	249	240 97	224,155	250	235·32	245,833	260	255·62	262,413	257	262·41
Nelson	5,464	229	244·36	6,447	236	250·16	7,215	239	269·27	4,322	245	272·36
Marlborough	2,913	237	247·20	2,567	239	247·67	2,151	239	249·70	1,944	228	232·63
Westland	2,321	229	234·54	4,902	232	241·59	2,816	236	260·89	2,773	241	273 17
Canterbury	2,627	212	220·57	2,155	219	226·67	4,129	223	233·38	4,449	236	255·26
Otago	3,535	228	237·94	4,319	236	252·03	4,685	238	249·02	3,568	229	264·85
Southland	7,401	231	249 47	6,896	237	261·26	9,350	235	256·32	7,420	227	264 66
South Island ..	24,261	229	241·81	27,286	234	249·63	30,346	235	255·11	24,476	234	262·76
Dominion	260,469	247	241·05	251,441	253	236·87	276,179	257	255·57	286,889	255	262·44

Government Subsidy.

The New Zealand Herd-testing Central Executive has held two meetings during the season. The amount of Government subsidy available for the current financial year—that is to say, applying to the past season's testing—is £5,000. After special grants for new groups, &c., are allowed for, this enables a payment to testing dairy-herd owners of 2½d. per cow for Group testing and 1d. per cow for the Association Own-sample system.

Appreciation.

We desire to again express thanks to officers in charge of herd-testing organizations for providing the particulars required for the compilation of this survey. The data submitted last season were so complete and accurate that every summary could be used.

SEED CERTIFICATION.

SUMMARY OF OPERATIONS FOR SEASON 1933-34.

J. H. Claridge, Assistant in Agronomy, Plant Research Station, Palmerston North

The seventh season's activities in connection with seed certification undertaken by the Fields Division of the Department of Agriculture is dealt with in the following summary of operations for the season 1933-34. There has been a reduction of 24 per cent. in the number of areas of the various crops inspected, the total for 1933-34 being 1,995. This reduction is confined to areas of perennial rye-grass.

The certification scheme has been extended during the season to include swede and turnip seeds, while several alterations have been made to the procedure in regard to certain other crops. Particulars regarding each crop are discussed under the various headings.

Perennial Rye-grass.

An important change in the classification of certified rye-grass seed has been made in the season now closing. In the past, two subclasses have been recognized within the "Permanent Pasture" class—namely, "Permanent Pasture (First Harvest)" and "Permanent Pasture eligible for reclassification as Mother Seed." These two subclasses have now been deleted, and all seed thus classified previously now comes into the ordinary "Permanent Pasture" class.

This alteration has brought about two main results: Firstly, the simplification of the classes of certified perennial rye-grass seed, and, secondly, a reduction in the amount of Mother seed by the deletion of potential Mother seed areas.

A 43 per cent. reduction in the acreage inspected has been recorded for the 1933-34 season (from 23,000 acres to 13,000 acres). This reduction, coupled with a reduction by 16 per cent. in the average yield, has resulted in the certification of only 119,000 bushels of machine-dressed seed, as compared with 246,000 bushels during 1932-33.

The general run of yields in Canterbury and parts of Otago was very disappointing. In North Canterbury, for example, the average yield was less than half that of the previous season.

There has been no difficulty in the great majority of cases in obtaining the required standard of purity for certified rye-grass seed. The germination of most of the North Island lines has been good. In North Otago and South Canterbury germination figures have been rather below the average, but in Otago and Southland the samples tested have returned improved percentages as compared with those of previous seasons.

Cocksfoot.

The 1933–34 season has been a very unsatisfactory one from the point of view of the cocksfoot-seed grower. Whereas in 1932–33 some 600,000 lb. of machine-dressed seed was obtained, at an average yield of 160 lb. per acre, in the season just ended the average yield fell to 48 lb. per acre, giving a total certified production of 200,000 lb. Eighty per cent. of this seed was produced on the Akaroa Peninsula, under the immediate supervision of the Akaroa Cocksfoot Seed Growers' Association.

Only 3,000 lb. of the total seed failed to qualify in the " Mother Seed " class, the determining factor being one of age.

White Clover.

There has been a considerable increase (from 3,000 lb. to 7,000 lb.) in the amount of Mother white clover seed produced in the past season In the case of Permanent Pasture seed, on the other hand, the supply has fallen from 31,000 lb. to 13,500 lb

A number of areas which have been sown with certified Mother seed are now being offered for certification. Two thousand five hundred pounds of the seed included in the Permanent Pasture class was harvested from such areas.

In addition to the above, there are some areas, particularly in parts of North Canterbury, which it is considered are reasonably certain to be of Mother seed standard, despite the fact that no sample trial report on seed harvested from these areas has yet been obtained. The produce of eleven such areas has been held under official supervision until such time as a sample trial report is available. It may then be found possible to certify to part or all of this seed.

Brown-top.

The number of areas of brown-top under certification has shown an increase from 85 in 1932–33 to 103 in 1933–34. Two of the areas inspected, both in South Canterbury, were rejected on account of the presence of red-top, but all other areas were accepted.

One hundred and nineteen thousand pounds of machine-dressed seed has been obtained from these areas—a reduction of 16,000 lb. on the previous season's production. Over 50 per cent. of the seed certified was produced in the Otago District.

Red Clover.

The harvesting of certified Montgomery red clover seed has been more firmly established during the 1933–34 season. Thirteen areas, totalling 165 acres, have been accepted, compared with 4 areas (71 acres) in 1932–33 Three of these areas have been accepted as Mother seed areas, from which 4,443 lb. of machine-dressed seed has been sealed and tagged, while 12,820 lb. of machine-dressed seed has been obtained from the Permanent Pasture areas harvested. The total production amounts to 17,263 lb., as against 3,763 lb. for the season 1932–33. The average yield per acre is equal to 103 lb.

WHEAT.

While the acreage of wheat entered for certification in the 1933-34 season shows an increase of almost 1,000 acres over that for the previous season, the acreage passed (1,100 acres) is 400 acres less. A few crops were entered this season from the North Island, but the majority of the crops were grown in Canterbury. There has been an increase of 300 sacks branded in the paddock this season, 6,700 sacks having been so treated. The quantity of seed machine-dressed has fallen from 7,000 to 6,000 bushels, however.

POTATOES.

The number of potato crops inspected in the 1933-34 season constituted a record, when 429 areas were entered for field inspection, exceeding by 66 crops the previous highest number (in 1929-30). The number of crops passing inspection was also considerably higher than in any previous season.

This season, for the first time, no crops were rejected on account of the presence of foreign varieties. The position in regard to the purity of crops in certification may therefore be regarded as entirely satisfactory. The amount of rejection on account of high virus infection or low cropping power is 23·8 per cent., a considerable improvement on the figures of any previous season, despite the fact that a gradually higher standard is being adopted each year in this respect. Aucklander Short Top and Dakota are again the most popular varieties, though the number of Arran Chief crops has considerably increased. Arran Banner has risen to fourth place in regard to the number of lines entered of any one variety.

An alteration in the classification of those crops provisionally certified has been adopted in connection with this season's crops. In addition to the classification into groups, which was introduced for the season 1932-33, crops are now classified also as either "Mother" or "Commercial" This classification depends upon whether it is considered that the crops are worthy of further multiplication for the production of certified seed, or whether they are of a slightly lower standard, but still quite suitable for the production of crops of commercial potatoes.

The quantity of seed potatoes that has passed the tuber inspection to the end of October amounts to 1,142 tons of Mother seed and 590 tons of Commercial seed, an increase of 800 tons on the quantity similarly treated in the 1932-33 season. The number of entries in the qualification trials totalled 149, a slight increase over the number in the previous season. A rather higher percentage was classified in the highest-quality group, there also being a fewer number of badly mixed lines.

TURNIP AND SWEDE SEED.

The certification of turnip and swede seed was inaugurated in the 1933-34 season, when 15 areas (133 acres), comprising eight varieties, were entered, the majority being entered by one grower. One area of 5 acres was rejected on account of varietal impurity, the others all reaching the necessary standard for certification.

Over 22,000 lb. of seed has been finally sealed and tagged. The yield of seed from the areas entered has been low, averaging only 177 lb. per acre.

ALL CROPS IN CERTIFICATION.

The following table summarizes the acreages of each crop inspected since the inauguration of certification in 1927:—

Seed.	Chief Consideration upon which Certification is based.	Acres inspected each Season.						
		1927–28.	1928–29	1929–30	1930–31.	1931–32.	1932–33.	1933–34.
Potatoes ..	Varietal purity, cropping-power, and freedom from virus diseases	821	900	1,200	1,331	1,146	1,154	1,322
Wheat ..	Varietal purity and freedom from loose and stinking smuts	473	1,184	2,277	3,289	1,063*	1,873	2,937
White clover ..	Ages of pasture, 1928–31. Type of clover, 1931–34	.	325	664	311	31†	100†	538
Perennial rye-grass	Genuine perennial type conforming to certain standards of purity	..	.	3,028	6,539	9,709	22,917	13,236
Brown-top ..	Freedom from red-top (*Agrostis palustris*)			22,000	24,901	18,297	14,860	17,370
Cocksfoot ..	Type as exemplified in the produce of Banks Peninsula				..	4,226	5,097	5,485
Montgomery red clover	Type conforming to that of English-grown Montgomery red clover	.		..	..	9	71	183
Turnips and swedes	Varietal purity and freedom from disease		.	.	..	..		133
Totals ..	..	1,294	2,418	29,169	36,374	34,481	46,072	41,204

* An alteration in the regulations was the cause of this reduction.
† Reduced area due to alteration of standard from one of age to one of type. Acreage given does not include white clover, which was separated from rye-grass during machine-dressing.

NOTE.—Persons or firms interested in the complete tabulated results may obtain copies of these upon application.

HARVESTING OF BARLEY AND WHEAT.

OBSERVATIONS ON THE BINDER, WINDROW, AND DIRECT HEADING METHODS.

C. H. HEWLETT and J. H. HEWLETT, Canterbury (N.Z.) Seed Co., Ltd., and H. E. WEST, Wheat Research Institute, Christchurch, N.Z.

DURING the harvest of 1933 comparative tests of harvesting barley and wheat by the binder, windrow, and direct heading methods were conducted on the Canterbury (N.Z.) Seed Co.'s farm at Leeston by the writers of this article.

In order to ascertain the effect of the different methods of harvesting upon the quality of the grain, 101 moisture tests of the grain in the field at various stages were taken.

Further, 117 analyses of the barleys and wheats after threshing were made. The barleys were malted and analyses made of the malt. The wheats were made into bread and the baking scores recorded.

Satisfactory results regarding quality were obtained from barleys and wheats harvested by the binder and windrow methods, but the

quality of the direct-headed grain was not equal to that of the wheats harvested by the binder or windrowed. The windrowed grain dried faster than the stook-threshed.

It would be preferable if four or five years' results were available, but they are not, and, without entering into detail, our conclusions based upon the one year's observations are as follow:—

Binder Method.—Satisfactory for all grain.

Windrow Method.—Satisfactory for all grain. Cheaper than binder method and very little more expensive than direct heading.

Direct-heading Method.—Unsatisfactory for barley. Satisfactory for solid-straw Tuscan wheat only, provided suitable weather conditions prevail.

TURNIPS OR BLUE LUPINS AND ITALIAN RYE-GRASS FOR WINTER SHEEP-FEED.

SOME RECORDS OF THEIR CARRYING-CAPACITY ON MEDIUM TO LIGHT LAND IN CANTERBURY.

A. H FLAY, Canterbury Agricultural College, Lincoln

OF recent years the successful growing of turnips on medium and light land for winter feed has become more uncertain. In the autumn of 1933 the diamond-back moth ruined most crops either partially or wholly. This winter, 1934, turnips and swedes were, in some instances, badly affected with dry-rot, and up to 20 per cent. of some crops have been rendered useless. The value of a good turnip crop, especially along the foothills where high yields can be secured, is not questioned, but it is interesting to note that simultaneously with the difficulty and uncertainty of turnip-growing more and more attention is being given to the use of lupins. This development is most marked on medium and light land. The different uses to which blue lupins are being put, the time of the year at which they may be eaten to the best advantage, and the best stage of growth for sheep grazing for various purposes have not, as yet, been clearly defined. Their economic uses under various systems of farm-management await further investigation. However, when sown with Italian rye-grass their use as winter feed has been demonstrated on medium to light land by an Ashburton farmer. The experiences of this farmer and his records of the winter carrying-capacity of turnips and of blue lupins with Italian rye-grass form the basis of this article.

In the season 1931–32 this farmer "headed" a crop of lupins on 28th December, 1931. This was the first time he had grown them as a cash crop and a "nor'-west" wind was responsible for a loss of seed. Some of the seed which had fallen on the ground was eaten by the lambs and sheep, the remainder was ploughed in during early February. The original intention was to follow the lupins with wheat, instead of which the wheat was sown in the field fallowed for turnips, and 20 lb. of Italian rye-grass seed per acre was drilled in over the ploughed-in lupin-seed. This was done with the object of securing the maximum bulk of winter green feed to replace turnips.

Method of Grazing.

The sheep were kept in a holding paddock and put on to " breaks " of turnips or lupins with Italian rye-grass for several hours daily. When there was ample or a probable surplus of winter feed, or ewes were being fattened on turnip-tops, full-time grazing was allowed. In the spring full-time grazing of the Italian rye-grass was also practised. Supplementary feeds, hay, chaff, or chaffed straw were used in sufficient quantities to enable the succulent feed to be rationed throughout the winter period.

In the winter of 1932 the largest proportion of the lupins were in the " full-leaf " stage, just before flowering, which actually took place on some plants in the last break to be fed in September. The following winter (1933) the lupins were not as far advanced in growth as in the

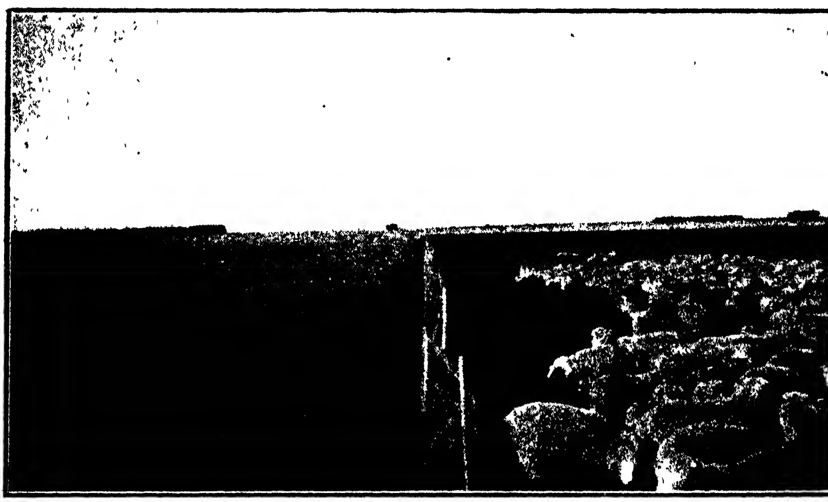

FIG. 1. BLUE LUPINS AND ITALIAN RYE-GRASS BEING GRAZED AS WINTER FEED ON FARM OF MR W. HAMMOND, WINCHMORE, ASHBURTON.

[Photo. by A H. Flay.

previous one and even at the time of feeding the last break the flowering stage had not been reached. However, it would have required only a few more weeks, and many plants would have flowered in the latter part of September or early October. During the first winter the sheep distinctly preferred the Italian rye-grass at the beginning of grazing. As the winter advanced this preference was less and less marked until it ceased to be noticeable. In the second winter (1933) those sheep used to lupins ate them readily enough, but sheep new to such feed repeated the performance of the main mob in the previous year. Toward the end of both winters all sheep ate the lupins readily, even on new breaks.

In grazing the lupins the sheep nipped the stalk at a height of 6 in. to 12 in. or more from the ground. Of the fallen part the stalk and leaves were eaten to about 4 in. to 6 in. of the tip. This last 4 in. to

6 in. was rarely eaten, usually being left on the ground. It appears to be distinctly unpalatable. The green leafage on the remaining standing stalk was eaten off and the stem, if young and succulent, was eaten fairly close to the ground. After being grazed down the lupins did not grow any further.

Records and Carrying-capacity of Turnips.

The last crop of turnips grown on this farm was grazed in the winter of 1931. Fortunately, complete records were kept of three crops which were consumed in the winters of 1929, 1930, and 1931. For this locality the crops grown were good. It will be recalled that during these years the seasons for turnip production were more favourable than those of more recent times.

As calculated from the records of stock grazed (see appendix) the carrying-capacities for the winters of 1929, 1930, and 1931 are given in Table 1.

Table 1.—Records and Carrying-capacity of Turnips.

Month.	Monthly Carrying-capacity per Acre as Dry Sheep.		
	1929	1930	1931.
April ..	..	0·4	..
May ..	..	2·3	1·9
June ..	..	6·4	0·7
July ..	10·2	11·2	11·2
August	9·8	10·0	14·8
September	6·1	..	4·4
October	..	..	1·0
Average for three-month period	8·7	10·1	11·3

Records and Carrying-capacity of Blue Lupins with Italian Rye-grass.

As calculated from the records of the sheep grazed (see appendix) the carrying-capacities of blue lupins and Italian rye-grass for the winters of 1932 and 1933 are given in Table 2.

Table 2.—Records and Carrying-capacity of Lupins and Italian Rye-grass.

Month.	Monthly Carrying-capacity per Acre as Dry Sheep.	
	1932.	1933.
June ..	3·6	0·1
July ..	9·6	8·9
August ..	9·8	11·6
September	4·9	4·0
Average for three-month period	9·3	8·2

The lupins with Italian rye-grass proved very satisfactory as a winter feed, lambing, spring, and early summer feed, besides yielding

a profitable crop of grass-seed from a portion of the area. The favourable results of the first trial led the farmer to grow another crop of lupins and Italian rye-grass to replace turnips for the winter of 1933. The lupins and Italian rye-grass were drilled in during February, 1933, on a well-prepared and fallowed seed-bed, and, despite the record dry autumn of 1933, they grew satisfactorily. By mid-June the lupins had made about 1 ft. less growth than in the previous season, when they averaged from 3½ ft. to 4 ft. in height (see photos).

Spring Grazing from Italian Rye-grass.

After the winter grazing of each crop of lupins and Italian rye-grass the rye-grass came away in the spring and was used for lambing green feed, and later for grazing ewes and lambs. Each year a

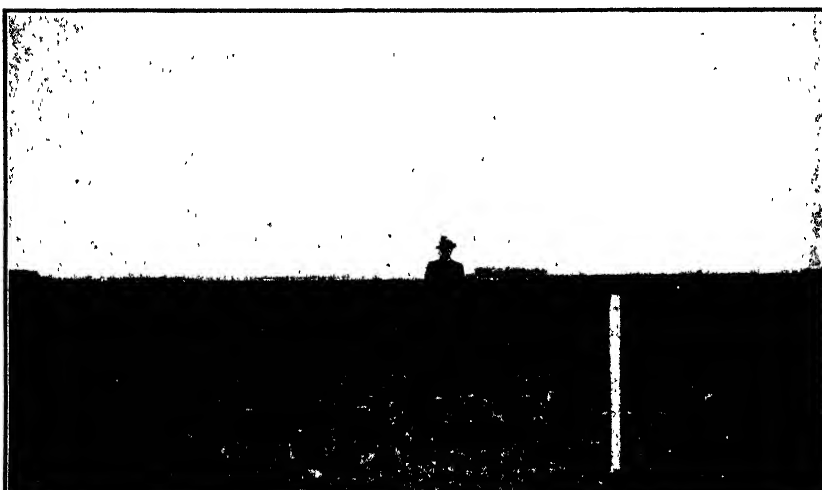

FIG. 2. BLUE LUPINS AND ITALIAN RYE-GRASS.

[*Photo. by A. H. Flay.*

portion of the field was closed for grass-seed. The grazing obtained from this grass throughout the spring for the two seasons is given in Tables 3 and 4.

Table 3.—Spring of 1932.

Year.	Month.	Carrying-capacity per Month as Dry Sheep per Acre.	Carrying-capacity per Month as Ewes and their Lambs Per Acre.
1932 ..	September	0·71	..
1932 ..	October	2·16	1·80
1932 ..	November	3·20	2·42
1932 ..	December	4·45	3·01
1933 ..	January	2·26	..
1933 ..	February	1·32	..

The last break of lupins was finished on 10th September, and at that time 11 acres of the earlier grazed portions were closed for grass-seed. It will be seen, therefore, that the grazing of the Italian rye-grass as lambing-feed during September, although calculated as from the whole field of 26 acres, is in reality from perhaps not more than half of this area. Also the grazing of this area was not commenced until the 12th September. The last break was finished on 10th September and here the Italian rye-grass provided little feed until October. The hard winter grazing has a weakening effect on the plants and a certain rest period is necessary for recovery. These notes explain the low carrying-capacity of the Italian rye-grass during the month of September.

From the records of stock movements the grazing from the Italian rye-grass in the spring of 1933 is calculated as follows :—

Table 4 - Spring of 1933.

Year.	Month.	Carrying-capacity per Month as: Dry Sheep per Acre.	Carrying-capacity per Month as: Ewes and their Lambs Per Acre.
1933 ..	September ..	1·12	1·00
1933 ..	October	2·08	2·23
1933 ..	November ..	3·15	2·38
1933 ..	December ..	2·84	1·91
1934 ..	January	2 00	..
1934 ..	February ..	0·05	..

Other than different dates for the finish of the winter grazing of the lupins and Italian rye-grass, and for the commencement of grazing the Italian rye-grass as lambing-feed, the same remarks as for season 1932 apply to the September figure. In the two seasons the Italian rye-grass, which was dying out, was ploughed in the latter part of February or early March for wheat, and on both occasions good crops were grown.

SUMMARY OF WINTER CARRYING-CAPACITIES.

The winter carrying-capacities of turnips and of lupins with Italian rye-grass are summarized in Table 5.

Table 5.—Carrying-capacity per Acre for a Three-month Period in Winter as Dry Sheep or In-lamb Ewes

Year.	Turnips.	Lupins with Italian Rye-grass
1929	8·7	..
1930	10·1	..
1931	11·3	..
1932	..	9·3
1933	..	8·2

It is readily conceded that such a comparison is not statistically sound, as the records, though for the same farm with a very even soil, are not replicated in the same season. However, the comparison does at least show that on light land where turnips are an uncertain crop a good winter carrying-capacity may be secured from an alternative crop—lupins with Italian rye-grass. As yet this latter crop is not subject to the diseases that play such havoc with turnips and swedes in some seasons. Further, in the dry autumn of 1933, when many turnip crops were a failure, this farmer had no difficulty in wintering his sheep without the use of large supplies of chaff and other supplementary feeds. On the other hand, where turnips can be grown with reasonable success, a portion of the turnip area can often be used profitably during the late autumn for fattening lambs. For this purpose lupins and Italian rye-grass, sown in February, are not well enough advanced and therefore would give a much lower carrying-capacity if used for fattening in, say, March and April. On this farm lupins and Italian rye-grass have not been tried for fattening lambs in the late autumn

A question which arises is whether Italian rye-grass grown alone or lupins grown alone and rationed similarly would give the same winter carrying-capacity as when grown together. No records are available for either of these crops under these circumstances. Regarding Italian rye-grass it is a fact that over a period of thirty years or more it has not established itself in this capacity. Although a bulk of green lupins which is consumed by sheep must provide feed, at least of some value, yet this value may not be as great without some green grass as with it. Perhaps the health of sheep may not be as good on pure lupins as on a mixture of lupins and grass. These matters all require thorough investigation. In the experience of this farmer, however, the ewes were in good condition after having been wintered in the manner described. Information about the time of sowing lupins in relation to their susceptibility to frost has also to be obtained. Both crops of lupins and Italian rye-grass just described were sown during February, and no damage by frost occurred in either year. It must be remembered, however, that both the 1932 and 1933 autumns were comparatively dry and that the lupins did not reach the flowering stage until October. The belief that lupins are sometimes poisonous to stock has not been supported.

In conclusion, it must be stated that the experiences of this farmer are not necessarily in any way considered applicable to every or any particular Canterbury farm. They are, however, recorded in the hope that those farmers under similar conditions may have the opportunity of knowing what has been successful on at least one farm where cropping and short-rotation or temporary pastures only are desired. Other farmers are sowing lupins as described herein, but with permanent pastures, instead of with Italian rye-grass, and rationing the mixture to ewes for winter feed.

Special thanks are extended to Mr. W. R. Hammond, Winchmore, Ashburton, who, throughout a period of five years, has kept detailed records which make the relating of his experiences of some real value. Without them this article could not have been written.

APPENDIX.

TURNIPS.

The details of the 1929 turnip crop are:—

An area of 36 acres was ploughed in August, 1928, hustled four times, harrowed, rolled, and drilled. Imperial Green Globe at the rate of 10 oz. per acre was sown in mid-January, 1929 It received 1 cwt. of superphosphate per acre.

The feeding of the first break was commenced on 30th June, when 442 ewes were rationed for four hours daily. The details of grazing are—

1929—

30th June to 16th September	..	442 ewes grazed four hours daily
26th July to 29th July ..	..	124 ewes grazed full time.
17th September to 18th September	..	227 ewes grazed full time
18th September to 19th September	..	2 ewes grazed full time
19th September to 20th September	..	225 ewes grazed full time
20th September to 21st September	..	5 ewes grazed full time
21st September to 23rd September	..	218 ewes grazed full time.
23rd September to 25th September	..	12 ewes grazed full time

During the period 30th June to 16th September 36 acres of deteriorated pasture were used as a holding paddock. In this field, which contained a little roughage, the ewes were fed about ¼ lb of hay per head per day. No hay was fed from the 16th September to the 25th September, during which time the ewes were put on to another field of pasture roughage If from the 30th June to the 16th September the hay and pasture roughage are considered as equal to one-fifth of the daily ration of the ewes, then the carrying-capacity per acre of turnips alone may be calculated for a three-month period

For the 1930 crop of turnips the following details are available:—

An area of 36 acres was sown with Imperial Green Globe at the rate of 10 oz. per acre in mid-January, 1930 It received 1 cwt of superphosphate per acre.

This season, grazing was commenced on the 26th April and continued as follows:—

1930 —

26th April to 5th May	..	99 ewes grazing full time.
6th May to 7th May	..	540 ewes grazing full time
8th May to 12th May	..	99 ewes grazing full time
12th May to 21st May	..	75 ewes grazing full time
24th May to 31st May	..	75 ewes grazing full time
1st June to 9th June	..	75 ewes grazing full time
9th June to 12th June	..	44 ewes grazing full time
17th June to 21st June	..	40 ewes grazing full time.
16th June to 16th July	..	547 ewes grazing three to five hours daily.
16th July to 14th August	..	471 ewes grazing three to five hours daily.
15th August to 1st September		438 ewes grazing three to five hours daily.

The turnips were finished on 1st September. During the period 16th June to 1st September the sheep had a run-out on to a 36-acre field of old grass which had grown a small amount of roughage. During the same period the ewes also received 73 sacks (24 to the ton) of oat-sheaf chaff and 76 sacks (40 to the ton) of wheat-straw chaff This supplementary feed, along with a certain amount of roughage, is calculated to provide about 20 per cent of the daily ration of each ewe during the period 16th June to 1st September.

The details of the 1931 crop of turnips are:—

An area of 36 acres, after being ploughed deeply, hustled three times, twitch-harrowed twice, rolled, and drilled, was sown with Imperial Green Globe at the rate of 12 oz. of seed per acre in mid-January, 1931. It received 1 cwt. of superphosphate per acre.

Grazing commenced on 1st May, using ewes and lambs which were being fattened. Winter grazing commenced on 1st July. Grazing was:—

1931:—

1st May to 9th May ..	..	50 sheep grazing full time.
9th May to 15th May ..	..	48 sheep grazing full time
15th May to 18th May	..	102 sheep grazing full time.
18th May to 20th May	..	135 sheep grazing full time.

1931—*continued.*

20th May to 10th June ..	72 sheep grazing full time.
1st July to 4th July	460 ewes grazing three hours daily.
4th July to 19th July	439 ewes grazing three hours daily.
20th July to 22nd July ..	439 ewes grazing three hours daily.
22nd July to 24th August ..	533 ewes grazing full time, with run-out on to bare oat stubble.
24th August to 5th September ..	520 ewes grazing full time, with run-out on to bare oat stubble.
7th September	520 ewes grazing for five hours only.
7th September to 11th September	210 ewes grazing full time.
11th September to 13th September	435 ewes grazing full time.
13th September to 15th September	67 sheep grazing full time.
28th September to 29th September	140 ewes grazing full time.
29th September to 1st October ..	18 ewes and lambs grazing full time.
4th October to 21st October ..	65 sheep grazing full time.

During the grazing of this turnip crop the only supplementary feed provided was a run-off on to oat stubble from 1st July to 22nd July. By the end of this period the stubble was eaten out.

Lupins and Italian Rye-grass

Details of Stock Grazing.—The details for the winter of 1932 are as follow.—

1931 : 29th December to 8th January, 1932	249 lambs grazed full time on shedded lupin-seed and stubble.
1932 :—	
9th January to 14th January ..	86 sheep grazed full time on shedded lupin-seed and stubble.
19th April to 26th April ..	57 lambs grazing full time.
6th May to 30th May	12 sheep grazing full time
18th June to 13th July ..	440 ewes grazing three to five hours daily.
13th July to 23rd August ..	486 ewes grazing three to five hours daily.
4th August to 5th September ..	124 ewes grazing full time.
28th August to 10th September	486 ewes grazing full time.

On 10th September 11 acres of the 37 acres was closed for seed. From 12th September the first breaks to be eaten off were used, firstly, for green feed for lambing and, secondly, for ordinary grazing. During the winter the ewes had a run-out on to a field of fair roughage, and were fed oat-sheaf chaff This supplementary feed has been calculated to equal 25 per cent. of the daily ration of a ewe in the winter period, 18th June to 10th September.

The details of the 1933 crop of lupins and Italian rye-grass are :—

An area of 38 acres, having been ploughed in August, 1932, hustled four times, harrowed, drilled, and rolled, was sown with 2 bushels of lupins and 20 lb. of Italian rye-grass per acre on 14th February, 1933. It received 1 cwt. of superphosphate per acre.

The grazing details of this crop are :—

1933 :—	
11th June to 1st August	6 ewes grazing full time.
2nd July to 2nd September	440 ewes grazing four hours daily.
2nd September to 3rd September ..	435 ewes grazing four hours daily.
3rd September to 6th September ..	350 ewes grazing full time.
6th September to 9th September ..	260 ewes grazing full time.
9th September to 11th September ..	220 ewes grazing full time.
11th September to 13th September ..	201 ewes grazing full time.
13th September to 14th September ..	190 ewes grazing full time.
16th September to 17th September ..	203 ewes grazing full time.
17th September to 18th September ..	15 ewes grazing full time.
22nd September to 23rd September ..	143 ewes grazing full time.
23rd September to 25th September ..	11 ewes grazing full time.

The last break of lupins and Italian rye-grass was finished on 25th September. The first break to be fed off, which had about two months' growth of rye-grass, was again used as lambing-feed from mid-September. Allowance similar to that in previous years has been made for oat-sheaf chaff and holding-paddock grazing.

SIGNS OF HEALTH IN DOMESTIC ANIMALS.

C. V. DAYUS, District Superintendent, Live-stock Division, Department of Agriculture, Dunedin.

BEFORE it is possible to recognize any departure from health and apply appropriate treatment on logical lines, it is clearly necessary to have some conception as to what constitutes the normal healthy animal. In view of the fact that animals are unable to contribute any direct help, it is necessary to depend to a very marked degree on our powers of observation of the symptoms presented in forming a diagnosis. The daily observation of healthy animals and a sound practical knowledge of the feeding and rearing of live-stock constitute essential ground work to facilitate recognition of symptoms of disease.

WHAT IS HEALTH ?

A question which arises is—What is health ? Health may be defined briefly as that condition of the animal in which all the functions are performed normally. What one calls healthy or normal is simply what the most extensive experience has proved to be the commonest condition. This applies alike to the structure, functions, and chemistry of the body. So it is recognized that what is healthy or normal in animals of one species may not be so in other species. For example, a pulse-rate which is normal in the dog would be evidence of disease in a horse under identical circumstances and *vice versa*.

A healthy animal should eat, drink, and sleep well and regularly, and should be bright in manner. The posture should be normal and easy, disease being indicated by irregularities such as resting limbs, outstretched nose, pendulous ears or lips, inappetence, &c. Change of habits often indicates disease. The various functions must also be normal, such as the pulse, respiration, temperature—both internal and external—and excretions. Rumination in the case of ruminating animals should be regular, and the same applies to lactation in milk-yielding females.

THE PULSE.

The pulse is an expansion of an artery due to the rise of pressure as the result of each contraction of the heart. The pulse wave gives most valuable information as regards the state of the circulation; it gives one the rate of the heart's action and the strength of the various beats. The volume, tension, and form of the pulse can also be determined. Certain variations, uniform in all animals, occur in the pulse-rate. It is always much quicker in the young animal than in the adult. As the animal increases in age the pulse-rate drops, and in old age the pulsations are not only reduced in number, but are weaker. The pulse varies in character according to age, condition, and state of the system. The character is really more important than the actual number of beats. Variations in the pulse beyond certain limits are indications of some departure from health. As we recognize the vital importance of

the heart in sustaining life, we can appreciate the gravity of a weak, failing pulse. The pulse should be taken by the finger-tips on a medium-sized artery having a firm background.

In the horse the normal beat is 36 to 40 per minute. In the horse the pulse is best taken either at the submaxillary artery, where this vessel goes round the edge of the lower jaw-bone just forward of the angle of the jaw, or at the radial artery inside the elbow.

In cattle the normal beat is 45 to 50 per minute. In cattle the pulse is best taken at the radial artery, just below and at the back of the knee, or the coccygeal artery under the middle of the tail.

In sheep the pulse is somewhat variable, but averages between 70 and 80 beats per minute. It is easily taken at the femoral artery inside the thigh.

In the pig the pulse-rate also varies, but averages between 70 and 80 beats per minute. It is best taken at the femoral artery inside the thigh. It is not altogether easy to ascertain the pulse of the pig.

In the dog the pulse varies according to the breed, and ranges between 80 and 120 beats per minute It is easily taken at the femoral artery inside the thigh. In judging its character it is essential that the dog should be quietly handled and not excited. An intermittent pulse is quite a normal condition in the dog.

Respiration.

In health the chest-wall and the abdominal muscles should both take part in the respiratory effort, which should be regular and easy and free from any suggestion of jerkiness. The true character is most easily observed by watching the flank carefully while the animal is at rest before he is in any way disturbed. There is an approximate ratio in health of one respiration to four pulse beats. In diseased conditions this ratio is upset, and respirations may even exceed the number of pulse beats

The average number of respirations per minute in the horse is 8 to 12, in cattle 12 to 16, in sheep in winter from 15 to 20, while in summer respirations may be very hurried and exceed 100 per minute. In the pig and dog there is a wide range, depending partly on age, breed, and excitability, and it ranges from 10 to 20 respiratory efforts per minute when at rest.

Temperature.

The external temperature is the temperature of the skin and extremities, and is maintained by the distribution of heat through the circulation. Therefore it depends on the circulation in the part of the body examined. Hence it may be an indication of the heart's action and its power to drive the blood through the skin and remote parts of the body. In estimating the external temperature, the hand should be passed over the surface of the body and also the ears, muzzle, and limbs of horses; the base of the horns, the muzzle, and limbs of cattle; the snout of swine; and the muzzle of dogs.

The internal temperature is a thermometric measurement of the heat of the blood. It is usually taken in the domestic animals per rectum with an ordinary clinical thermometer. Care must be taken always to shake the mercury of the clinical thermometer well below the normal temperature of the animal about to be tested, and the instrument should be greased a little and well inserted. The temperature of health may vary within certain limits in the same animal. The normal temperature of any animal is slightly raised after a meal, during rumination and lactation, and in pregnancy of females. Work also raises the temperature somewhat, consequently the normal temperature of the same animal is usually a little higher in the evening than in the morning. In young growing animals the temperature is usually a little higher than in animals in the prime of life.

Temperature above the normal range is usually considered a febrile temperature denoting a fevered condition. When the temperature is excessively low, or subnormal, it is called a "collapse" temperature. This often indicates the approach of death. The normal temperature in the horse is 100·4 degrees Fahrenheit. For comparison, the average normal temperature of man is 98·4 degrees Fahrenheit. In cattle the normal is 100 to 102·5 degrees Fahrenheit In sheep the normal temperature is 101 to 104 degrees Fahrenheit. In the pig the normal is 101 to 102 degrees Fahrenheit, and in the dog 100 to 102 degrees Fahrenheit.

The Mucous Membranes.

Another helpful sign in regard to health is the appearance of the visible mucous membranes. Normally they are slightly moist and pink. Variations may occur in disease in each of those conditions. These membranes include the conjunctiva, which is exposed when the bottom eyelid is pulled down, and also the lining membrane of the nose and mouth. Variations in colour may be noted, due to the quantity and character of the blood circulating through the parts

The Skin.

In health the skin should be soft and supple, and freely movable upon the underlying structures. The coat should also be glossy and resilient or elastic, and not present a harsh feeling to the touch. A staring coat, consisting of a dry harsh condition of the hair is a common indication of unthriftiness The skin should not be hidebound, which is the term given to the condition in which the skin appears to be adherent closely to the subcutaneous structures, almost giving the impression of being too small for the body it covers. It is due to the arrest in the production of subcutaneous fat, and is therefore one of the results of malnutrition or emaciation from some wasting disease. In this condition it is impossible to raise the skin in folds as may be readily done in a well-nourished animal.

Miscellaneous Features.

In addition, in the case of the horse the general attitude and expression must be taken into account. In health the head is always on the alert, the eye is bright, full, and wide open. The

ears are alert and pricking to and fro. The fore feet are always square and firm on the ground, but one of the hind feet may be rested on the toe. It is noteworthy that the horse never rests a fore leg unless there is something the matter with it.

One of the main indications of health in cattle is the fact that there is constant leisurely chewing of the cud when at rest. Cattle spend about seven hours out of the twenty-four "chewing the cud." They generally commence this operation thirty to seventy-five minutes after a meal. Each "cud" is chewed thirty-five to fifty times by cattle according to the nature of its constituents. This occupies half a minute to 1¼ minutes, and then the cud is reswallowed. In from three to six seconds another "cud" has reached the mouth, and so the process continues.

In health there is a pronounced "dew" on the muzzle, the hair is licked up in places, the animal consorts with its fellows in the herd; if sick, the ox frequently separates itself from others.

Sheep in health are actively moving over country, feeding here and there or resting comfortably, leisurely chewing the cud. On opening the wool there is a healthy pinkish appearance of the skin, which is an indication of a thriving healthy animal. When disturbed healthy sheep rapidly move together; defective or sick animals separate themselves or lag behind the main mob.

The pig in health is always a free feeder, and ever looking for a meal. A healthy pig always has a curl in its tail, and frequently will be noted rubbing itself against a post or other convenient place.

The dog in health is bright, alert, intelligent, with a good glossy coat and a moist cold muzzle.

EXPERIMENTAL WORK ON THE CONTROL OF *PIERIS RAPAE* (WHITE BUTTERFLY) BY MEANS OF PARASITES.

The most important work that this section has had to deal with during the past year has been in connection with the biological control experiments on white butterfly. A survey in the field of the places where parasites had been liberated during the previous season indicated that the larval parasites (*Apanteles glomeratus*) were at work though they were not sufficiently prevalent to offer any serious check to an increase of the butterfly. The pupal parasite (*Pteromalus puparum*), on the other hand, was found to have spread considerably from its original point of liberation. During the present season further consignments of both larval and pupal butterfly parasites were imported and liberated. Four hundred and twenty-five thousand cocoons of the larval parasite were received from Farnham Royal, England, and from this material 240,000 parasites emerged and 5,000 hyperparasites. All of the latter on emergence were promptly destroyed. Two hundred and thirty thousand of the parasites which emerged were sent into the field. These were mainly concentrated in the Hawke's Bay locality, though a few were distributed in Gisborne, Tauranga, Taihape, Te Kuiti, and parts of the Manawatu district. From a brief survey of the Hawke's Bay locality, where the bulk of these parasites were liberated, only a small percentage of parasitized butterfly larvæ were obtained—not more than 3 per cent. were parasitized. It is not to be inferred from this, however, that these parasites are unsuccessful, as it often happens in biological control work that the insect which is the most difficult to establish subsequently proves the most effective.

With reference to the pupal parasites, namely *Pteromalus puparum*, 11,500 of these were distributed in the field, and again most of these were concentrated in the Hawke's Bay locality, though a few consignments were distributed in other places, including the Manawatu and Taihape districts. Of these 11,500 pupal

parasites liberated, 8,000 were reared at the Station. A recent survey in the Hawke's Bay District, where the main body of parasites was concentrated, indicates that they have become thoroughly established there and are doing good work. They have spread over hundreds of square miles of the Hawke's Bay territory, and there seems little doubt that they were at least partly, if not wholly, responsible for the large reduction in the prevalence of the butterflies in that district. In one survey it was found that, out of a total of 5,300 *Pieris rapae* pupæ collected at random in the field, 90 per cent. were parasitized. This work to date has been so successful that it has been deemed advisable to extend our activities to the extent of attempting to rear pupal parasites in very large numbers during the coming year in order, if possible, to be able to liberate them in selected localities throughout New Zealand where the butterfly is prevalent. The work is now proceeding very satisfactorily, and we have at present 20,000 butterfly pupæ for parasitizing, and it is expected that at least another 20,000 or 25,000 will be secured before the commencement of the coming season

Apart from the biological control methods in connection with the control of the butterfly, a certain amount of information has been gathered from experiments conducted with chemical control methods. Out of a number of materials tried, the most successful control obtained was from the use of calcium-arsenate dust used in the proportions of 1 part of calcium arsenate to 5 parts of hydrated lime. This material, if dusted at the requisite intervals as required, gives an effective control of the pest The method, however, is only suitable for garden use or for the commercial grower of cabbages and cauliflowers It is not a method that can be economically adopted in general farming practice in this country —*Report of Entomologist for year ended March, 1934*

WOOL PRODUCTION.

Information as to production of wool is not obtainable directly, but it is possible to compute fairly accurate figures on the basis of exports and local consumption during the twelve months ended 30th June and the variation in stocks revealed by the annual census of stocks of wool held on 30th June

In the following computation of total production, scoured, washed, and slipe wool has been converted to a greasy basis on the assumption of an average loss of 33⅓ per cent. in weight, while wool exported on skins has been taken at an average of 4 lb. per skin

—	Year ended 30th June, 1930.	1931.	1932.	1933.	1934
	Million lb				
Exports of wool	207·2	244·3	248·1	310·0	308·9
Exports of wool on skins ..	4·8	6·4	6·8	11·1	14·4
Acquired by New Zealand mills ..	6·1	6·2	7·0	6·6	6·0
	218·1	256·9	261·9	327·7	329·3
Variation in stocks	+54·8	+14·2	+20·9	−39·3	−28·8
Estimated production ..	272·9	271·1	282·8	288·4	300·5

Production for the year ended 30th June, 1934, shows an increase of 12·1 million lb. over the total production of 288·4 million lb. for the previous season. Contrary to anticipations early in the season, the yield per sheep shorn proved to be higher in 1933–34 than in 1932–33, and the position was further affected by a record lambing (with a greater number of lambs shorn), and by a later killing season. It is probable also that, with the much higher prices ruling for wool, farmers would endeavour to realize on their dead wool, crutchings, &c., to a greater extent than in immediately preceding years.—*Abstract of Statistics.*

AGRICULTURAL AND PASTORAL STATISTICS, 1933–34.

PRELIMINARY statistics for the season 1933–34 are now available, and figures for the principal items are here given, last year's final figures being shown also for purposes of comparison.

Attention is directed to the fact that the crop figures relate only to holdings of 1 acre or over located outside borough boundaries. The live-stock figures, on the other hand, include allowances made for live-stock in boroughs and on holdings of less than 1 acre in extent.

PRINCIPAL CROPS.

Name of Crop.	Areas.		Yields.		
	1932–33.	1933–34.	Unit.	1932–33.	1933–34.
Wheat—	Acres.	Acres.			
For threshing..	302,531	286,285	Bushel	11,054,972	9,036,319
For chaff, hay, or ensilage	2,180	2,264	Ton	4,533	3,373
Fed off or cut for green fodder	1,213	6,457	..	..	..
Oats—					
For threshing..	116,206	78,346	Bushel	5,132,183	3,242,564
For chaff, hay, or ensilage	259,294	218,195	Ton	453,503	357,957
Fed off or cut for green fodder	49,087	68,242	..	..	..
Barley—					
For threshing..	16,336	21,024	Bushel	561,017	730,963
For chaff, hay, or ensilage	860	777	Ton	1,952	1,931
Fed off or cut for green fodder	6,280	7,803	..	..	..
Maize—					
For threshing..	8,153	8,257	Bushel	389,432	373,228
For ensilage ..	636	448	Ton	5,088	3,601
Fed off or cut for green fodder	6,361	8,571	..	..	..
Peas for threshing	22,370	30,362	Bushel	585,418	698,293
Linseed for threshing	333	1,441	Cwt.	2,705	12,564
Potatoes	24,605	25,038	Ton	129,079	127,417
Onions..	1,134	1,112	,,	9,203	9,452
Rye-grass, harvested for seed—					
Perennial	68,992	38,989	Lb.	26,242,734	12,660,579
Italian and Western Wolths	17,932	6,941	,,	9,696,743	2,503,012
Cocksfoot harvested for seed	11,293	9,496	,,	2,335,497	724,684
Grasses and clovers cut for hay	409,974	378,183	Ton	762,146	690,957
Grasses and clovers cut for ensilage	116,495	92,271	,,	467,596	369,002
Lucerne cut for hay or ensilage	35,867	35,906	,,	106,095	107,182
Turnips (including turnips and rape mixed)..	472,995	478,682	..	..	..
Mangolds	11,961	13,747	..	..	..
Tobacco	2,126	1,803	Lb.	1,784,676	1,239,946

—*Census and Statistics Office.*

There is no parochialism in agricultural research the world over. The information is broadcast and is available for whosoever will use it. New Zealand in the past has been particularly fortunate that this is so, and, while at the moment we may regard New Zealand as evolving towards strains in plants and animals that may be superior to the original importations, yet we must not close our eyes to the fact that agriculture the world over is progressing along scientific lines and the importation of new improved stocks may enable us to make even better use of the wonderful climate, soil, and talent we possess in the competitive race for agricultural supremacy. The importation of species and strains should go hand in hand with the improvement of our present-day species and strains.—*Report, Agrostologist.*

PIG-FEEDING EXPERIMENTS.

Groups of pigs from the same litter were fed after weaning, the one group on whole milk and the other on skim-milk of 0·15 per cent fat content. Both groups were given meat-meal only as a supplement, but no green food. After three weeks, when they were settled on these foods and were growing well, *B. Suipestifer* was introduced by culture into both groups. The skim-milk group scoured badly, one died, and one became very ill but later recovered. This group was put back over 10 lb. on the average at this stage and did not catch up with the whole-milk group. This latter group did not show any effect whatever from the *Suipestifer* culture, for they grew well and were extraordinarily good pigs. At post-mortem the blood was found to be normal chemically in both groups, with no significant difference, there was a positive agglutination in all pigs to *B. Suipestifer* antigen, this being absent at the commencement of the experiment, and the organs were on the whole normal except in the heaviest and best pig of the whole-milk group, which had an ulcerated caecum. The protective power of the whole milk was therefore evident. Other experiments on these lines are being planned for the new year. Skim-milk was found to be almost entirely deficient in Vitamins A and D while whole milk contained twenty-eight units of Vitamin A per pint, a fair but not a high figure.

This shortage of Vitamin A in skim-milk is quite likely to be responsible for the trouble in young pigs, which ranges from alimentary and respiratory infection to nerve degeneration, ending in paralysis Luckily feeding with materials rich in the accessory food factors offers no management difficulties - *Annual Report, Wallaceville Veterinary Laboratory*

SEASONAL NOTES.

THE FARM.

Summer Top-dressing.

UNDER conditions typical in essential particulars of those obtaining in the main dairying districts, a limited number of dairy-farmers have carried out top-dressing in recent years with superphosphate on some of their pastures in late November or in early December. These farmers have been so satisfied with the results from such top-dressing that they intend to persevere with it. The tendency in this connection seems to be to prefer November to December top-dressing, partly because the farmer usually is not quite so busy in November as in December, and partly because there is a greater period in which the November dressing may make its influence felt before the advent of the relatively dry conditions that occur widely after mid-summer From their experience the farmers say that the summer top-dressing increases appreciably the amount of fresh, leafy feed available in the latter part of the summer—this is most marked when the summer rainfall favours growth, but it also occurs under relatively dry conditions when any additional fresh, leafy growth generally is especially useful The farmers' experience just cited relative to the increased summer supply of leafy feed is in complete accordance with the results of carefully conducted field trials which have been carried out for several years at Marton and Ruakura and which involve accurate weighing of the growth resulting from the various treatments It is to be expected that, as the December-January rainfall decreases, summer top-dressing will decline in effectiveness as a means of obtaining additional fresh, leafy growth in late summer until a point is reached when it is probably not worth doing. The experience that recently phosphated pastures withstand conditions of relative drought in a more satisfactory manner than similar pastures which have not been phosphated is in agreement with much other field experience Even if exceptional conditions, abnormally dry for the districts under consideration, obtain, the benefit from summer top-dressing with superphosphate merely is mostly deferred but not lost. The field experience under consideration relates to districts in which a December–January rainfall of at least 5 in. to 6 in. is normal, and has no reference to districts of really low summer rainfall.

Areas from which hay or silage have been saved usually respond profitably to a December application of superphosphate, which tends to increase the production of leafy feed at a season when it is frequently in scant supply.

Weaknesses in Summer Feeding of Stock.

Though farmers in general are more concerned about their shortcomings in respect to the winter feeding of stock, and though there is much scope for improvement in respect to winter feeding, there is probably just as much inefficient summer feeding as there is inefficient winter feeding of stock. And, unfortunately, some of the inefficiency in summer feeding cannot be as readily removed as the inefficiency in winter feeding.

Inefficient summer feeding is of two distinct types. In the first place, in early summer an important and a common weakness in the feeding of "wet" stock, including sows and ewes as well as dairy cows, lies in the quality as distinct from the quantity of the feed. On the other hand, for some weeks after midsummer while the supply of feed is sometimes deficient in quality, it is probably more often deficient in quantity. As the early summer weakness in respect to quality is to some extent interrelated with the later weakness in respect to quantity, the two conveniently may be considered together.

In practice, enough consideration does not seem to be given to the fact that the bulk or weight of such important summer crops as grass and clover, green lucerne, and green millet is very misleading as a measure of their feeding-value. The facts relative to grass and clovers exemplify in essential respects the position in regard to the other crops mentioned. The dry matter—*i.e.*, the residue after all water has been removed—of leafy pasture contains approximately twice as much phosphate and lime as the same amount of dry matter from corresponding herbage at the hay stage of growth; similarly it contains about two and a half times as much protein, and, further, about 80 per cent of the dry matter of leafy herbage is digestible, whereas only from 40 to 50 per cent of the dry matter of similar pasture in the hay stage is digestible. The practical importance of these facts is that the rations of "wet" stock frequently fall short of requirements in mineral matter which is required for bone and milk formation, in protein which is required for milk and flesh formation, and in digestibility—high or rapid production is necessarily linked with high digestibility.

A measure of the feeding-value of typical leafy pasture is the fact that its dry matter is practically identical with that of the standard concentrate, linseed cake. On the other hand, a substantial part of the dry matter of a stemmy or woody crop is analagous in nutritive value to sawdust and, further, dry matter of this sort affects detrimentally some of the remaining dry matter by making it less digestible In brief, leafy grass and kindred feeds are essentially diluted high-class concentrates, whereas stemmy growth tends to belong to the inferior class of feed which is sometimes termed "roughage" or "coarse fodder"

The basic differences between leafy and stemmy pasture growth emphasize the need for management which as consistently and continuously as possible will beget leafy growth. This management consists primarily of the systematic grazing, ensilage, and "topping" which were described in some detail in these notes in the previous *Journal*. Further information directly applicable to specific circumstances is obtainable from local officers of the Fields Division.

It is of considerable moment that pasture-management which will provide the desirable leafy feed in November and December as a rule ensures a greater supply of such feed later on than results when pastures are allowed to become coarse and stemmy before midsummer; pastures which have been allowed to reach the reproductive stage of growth, as distinct from the leafy or vegetative stage, seem to exhaust themselves to some extent in doing so, and even when they are shortened by mowing or grazing, do not at once produce leafy growth so freely as swards which have been kept short throughout But often they are not shortened, in part at least, and then the process of leaf-production is further delayed.

Because of considerations similar to those associated with pastures, such crops as lucerne, millet, and maize should as far as possible be utilized in the leafy stage. In this connection yield of feed deserves consideration. This applies in an important manner to lucerne because an important effect of repeated cuts of very leafy forage may readily be overlooked or accounted for incorrectly. Repeated cutting of immature growths of lucerne has been shown to be a drain on the plants, to lead to a rapid falling-off in yield and to a weakening of the lucerne plants, which is particularly likely to prove serious if the lucerne becomes invaded by other plants which outgrow it in winter and spring. Crops such as soft turnips, millet, and maize can be grown to meet any deficiency in leafy feed from pastures after midsummer, but if work relative to these is not already well forward then it becomes necessary to depend largely upon the aftermath from ensilage and hay paddocks and the maintenance of the pastures generally in a leafy condition by control of the growth through grazing and topping, and when this is the case grazing management becomes of vital importance. In seeking suitable

control of pasture growth just prior to midsummer, it is advisable to avoid grazing so closely that the pastures suffer on the advent of the dry, hot period that customarily occurs in many districts—it is probably wiser to have the pasture growth tending towards being too long instead of too short just before the expected advent of dry conditions during which it is desirable that the surface of the land be covered as completely as possible with vegetation. To sum up, much of the very common weakness in the feeding of "wet" stock in summer is to a large extent a grazing management weakness, and the measures which correct the weakness in quality in early summer help at the same time in remedying the weak position that commonly obtains after midsummer. To avoid drying out and scant production of pastures during dry summer conditions, care should be taken not to graze closely just prior to the expected advent of these conditions.

Control of pastures in summer is obtained much easier if swards are characterized by even growth. Regular and thorough distribution of droppings of cattle and horses by means of harrowing valuably assist in securing such even growth. It is advisable to try to avoid harrowing just before a dry spell, for it is preferable that the soiling of the feed which harrowing at times causes be removed by rain.

Haymaking.

From the foregoing facts about the feeding-value of the growth of pastures at different stages of development it may be deduced that when haymaking is practicable it is a mistake to postpone cutting hay crops until the heaviest possible crop is obtained While a few extra hundredweights may be harvested from an acre, many hundredweights of feed are deteriorating seriously. Further, the later the haymaking the more are naturally sward-forming species likely to be affected detrimentally and the less is the likelihood of the quick production of a prolific aftermath.

But because of weather conditions haymaking is at times not practicable when the hay crop is at the most suitable stage of growth for harvesting. This fact provides the basic and the sound cause of the popularity of ensilage in the main dairying districts. The advantages of mowing at the leafy stage of the bulk of the hay crop are so great that they well justify special measures to save hay in a good condition before it has become undesirably stemmy and mature Cocking is one of these measures; over much of the Dominion it is seldom possible to save a heavy crop of hay at the right stage of growth and in good condition without cocking. In this connection it is interesting that inquiries disclose that practically all the hay exhibited successfully at shows has resulted from cocking. To many, but not to all, it is unnecessary to point out that a hay-cock should not be a mere heap A hay-cock should be well-hearted and raked and efficiently built so that it will shed much rain and be wet only on the outside. Cocking is particularly useful in the securing of lucerne and clover hay of good quality.

If rainy and broken weather occurs immediately after mowing then, within reasonable limits, the mown material should not be handled until fine weather seems to have returned; handling of mown material increases the facility with which nutriment is washed out by rain. If there seems to be likelihood of bad weather, cocking should be hastened—the amount of leaching corresponds with the amount of rain which washes the material and the amount of rain which falls on the area occupied by the cocks is but a fraction of the amount which falls on the area occupied by the swathes.

Ensilage.

Some common faults in ensilage were discussed in these notes last month. Much further information is contained in Bulletin 146 obtainable free on application to the Department of Agriculture.

In general there is a proper place for both haymaking and ensilage on many farms which restrict their attention to one of these practices. Ensilage

should be carried on when weather is bad or uncertain, as it is more likely to be early in the season; but when good weather prevails haymaking usually should be adopted in preference to ensilage. Provided hay can be saved in first-class condition, there is as a rule no practical consideration which justifies handling the extra weight of material involved in ensilage. A possible exception to this would be a crop invaded by weeds such as thistles which in the form of silage is likely to be more edible to stock than as hay. One consideration which warrants the saving of both hay and silage is that on most farms special crops such as mangels and swedes should find a place and hay of good quality is generally a better companion feed to crops of this type than is silage.

General Cropping Work.

To some extent the appearance of seedlings of weeds in crops such as mangels, potatoes, carrots, &c., may really be a blessing in disguise—it compels attention to cultivation. Cultivation at times seems to be looked upon primarily as a means of keeping weeds in check and hence as a matter calling for action only when weeds are becoming troublesome. Actually the suppression of weeds is only one of several benefits resulting from cultivation. The general value of the cultivation that produces a fine firm seed bed is widely known although the knowledge is far from universally reflected in practice. But it is not so generally known that suitable cultivation subsequent to seed-sowing ensures better results from judicious expenditure on seed and manures and assists the crop in withstanding, without injury, a spell of dry weather which would cause a set-back to a similar crop poorly cultivated. At this season one of the most important aspects of forage cropping is the neglect of cultivation This applies not only to preparatory cultivation, but to intertillage of growing crops sown in rows wide enough to allow of it even though weeds are not disagreeably prominent

Often in December, hand in hand with tillage goes the work of thinning and weeding of crops sown in October and November—work which is made easier by prior hoeing along the rows. The best time to do thinning is as soon as the seedlings are of sufficient size to allow of the plants being handled without difficulty. Undue delay in thinning not only tends to stunt the crop, but also makes the work of thinning more difficult.

Maize and millet to provide green feed usually are sown successfully in November or December. Good results have been obtained by sowing maize broadcast at the rate of 75 lb. of seed an acre and covering the seed by a very shallow ploughing; disking may be employed as an alternative to such ploughing. Sowing millet at the rate of 15 lb. to 20 lb. of seed an acre has consistently given good results. Almost invariably both crops respond profitably to a dressing of superphosphate at the rate of 1 cwt. to 2 cwt. an acre, and unless the soil is highly fertile it is usually profitable to include also some nitrogenous material in the manurial dressing.

Over wide areas good results may be expected from sowing the important swede crop in December at the rate of 10 oz. to 14 oz. per acre of seed through every second coulter of an ordinary grain-drill, but sowing through every coulter has also given good results and especially in the South Island sowing in ridges followed by intertillage is widely practised and has consistently given heavy crops. A fine, firm seed bed favours a good " strike " of swedes. A popular practice is to apply about 3 cwt. an acre of manure of which phosphate is the dominant constituent. When the seed is mixed with the manure for sowing, injury to the seeds through bringing them in contact even for a short period with soluble manures such as superphosphate, sulphate of ammonia, and potash salts should be avoided. The injury caused by superphosphate can be obviated by

mixing the superphosphate with an equal weight of ground limestone (carbonate) about a week before sowing. The mixture usually sets hard to some extent and so should not be bagged until it has been made two or three days when it may be pulverized easily in the heap. Among the progressive farmers who participate in crop competitions the popularity of varieties of swedes varies considerably from district to district. In the North Island generally Superlative Grandmaster and Majestic are widely used, while in Southland Elephant and Masterpiece find favour. These selections of farmers are in general accord with work relative to varieties done by the Department.

Chou moellier maintains its deserved popularity. This is because of its marked resistance to clubroot, its good feeding-value, its consistently satisfactory yields, while calling for relatively little labour and the ease of feeding it without undue waste especially in wet-soil conditions. In its requirements relative to fertility chou moellier parallels the cabbage, and soils not naturally of high fertility must be suitably reinforced by liberal dressings of farmyard or artificial manure to produce good crops of chou moellier. Normally superphosphate should be prominent in the fertilizer applied to chou moellier December sowings are suitable for the production of winter feed. A suitable sowing is 1½ lb to 2 lb. an acre broadcast or ½ lb. to ¾ lb. an acre in drills 2 ft. to 2½ ft. apart.

As a rule, satisfactory results from spraying for the purpose of controlling potato-blight are obtained only when spraying is commenced early enough to serve as a preventive instead of as a cure—spraying in December is likely to be of distinct preventive value. If spraying is not proper in respect to either the materials or the methods employed, then it is likely either to damage the crop treated or to be ineffective against the disease. Full information about spraying may be obtained from local officers of the Department.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Control of Pests and Diseases.

SPRAYING operations recommended in these notes for September and October last should be continued for the control of powdery mildew, black-spot, pear-scab, codling moth, leaf-roller caterpillar, leaf-hopper, &c. on pome-fruit trees, and on stone-fruit trees for the control of brown-rot, aphis, leaf-rust, and other diseases. The strength of lime-sulphur in the combination spray should be reduced to 0·083 per cent from about the middle of December for apples The tender varieties such as Cox's Orange, Sturmer, and Dunns should receive the weaker strength in all sprays after the "petal fall" application For pears it is advisable to continue spraying with bordeaux-mixture 3–4–50 plus arsenate of lead 1½–100, as recommended in the September notes, for the control of pear-scab, codling moth, leech, &c. From the time these notes are published, applications should be made at intervals of fourteen to twenty-one days. In those localities, however, subject to fogs or heavy dews, or in ones in which there is a succession of wet days, the period between the spray applications should be reduced accordingly. Thoroughness of application to all parts of the tree and its appendages is of the utmost importance and becomes increasingly difficult to secure as the season advances and the foliage becomes more dense. If a high pressure is maintained a good coverage of all tree parts is more readily obtained.

All apple-trees that are subject to attack by powdery mildew should be examined at least twice while the trees are growing and all infected shoots cut out and destroyed. This practice is essential, at least in certain localities, for the satisfactory control of powdery mildew.

Thinning of Pome Fruits.

Thinning is an operation that consists of removing from the tree all undesirable fruit before it attains any appreciable size. Apart from the removal of diseased or otherwise injured fruit, this operation should be delayed until after the natural dropping which takes place about the second week in December. One object of thinning is to leave on the trees only the number of fruits that the tree can develop to a good marketable size, and in so doing arrange for the fruit to be evenly distributed over all tree parts. Another object is to prevent a wastage of tree energy by removing all fruits that will not be of a good marketable value when fully matured, such as fruits infected with black-spot or pear-scab, or injured with bronze-beetle or other insects. Fruits allowed to remain should be thinned so that no two will be touching when fully grown, provided there are sufficient fruits set to permit of this being done without reducing the crop excessively If single fruits only are retained the control of insects such as leaf-roller caterpillar, bronze beetle, and codling moth is much more readily effected.

Grafts.

All trees that have been grafted during the present season should be examined frequently. Where good growth has been made, the binding can now be cut. This is best done by drawing a sharp knife from top to bottom of the binding, and this as far distant from the scion as possible. It is not necessary or even advisable to further remove the binding which is still affording the union a certain amount of protection Shoot growth from the stock should not be allowed to overcrowd the scion and should be checked periodically by pinching back.

Cultivation.

The maintenance of a good tilth by frequent cultivation should on no account be neglected. Good cultivation not only maintains soil aeration, but helps to retain moisture, and generally provides conditions suitable for maximum crop and tree growth.

Cases.

An ample supply of fruit-cases for the coming season if not already attended to should be arranged for immediately, and its delivery made not later than December. This will permit of the cases being made up prior to the busy period of harvesting and provides for a final seasoning of the timber, if such should be found necessary.

Miscellaneous.

Machine graders, lidding-presses, wiring-machines, &c , should all be overhauled at an early date to ensure that everything is in perfect order for the commencement of the packing season Orchard ladders, picking-bags, &c , will need an examination to see that they are ready for the busy harvesting period. Packing-materials can be ordered now so as to make certain that supplies will be on hand when required, and generally everything possible should be done to lessen the rush of work usually associated with the commencement of harvesting.

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

In those localities where citrus trees have blossomed heavily, indicating a heavy crop of fruit, it will be necessary for the grower to realize he has a most important part to play in bringing that crop to maturity, and that this can be accomplished only by an additional application of some nitrogenous fertilizer, such as nitrate of soda or sulphate of ammonia, the quantity being regulated by the age and size of the tree and the amount of fruit that is promising.

The trees will have benefited greatly by the recent rains, and every effort should now be made to conserve moisture by lightly forking the top soil round each tree. Good tillage plays an important part in the development of the crop.

The treatment of young trees should not be neglected and all shoots starting low down on the stem should be removed. Strong perpendicular shoots which are not required for the framework of the tree should be cut back to induce side growth, and those wanted for the formation lightly tipped to ensure stability.

As indicated in the previous month's notes, a further spraying with Bordeaux 3–4–50 is necessary if verrucosis and scab is to be controlled. As the adult borers will now be on the wing, a careful lookout should be kept for any evidence of their working, and where small twigs are infected they should be immediately removed, and the larger limbs may be treated by the injection of benzine in to the holes and plugging with soap or putty. All ends of broken limbs should be cut to smooth wood, leaving no rough places on which the adult insect may lay her eggs.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Summer Management.

NEXT month is usually one of the most trying months of the year, particularly in regard to the developing stock. It is, therefore, a time which calls for the greatest care and thought on the part of the poultry-keeper in studying the requirements of the young birds and making the conditions as ideal as possible and thereby minimizing the risk of the young ones receiving a set-back during the hot weather. In the first place, they should be provided with an abundance of nourishing food. For the production of well-developed bodies and bone of the right quality and thickness, there is no food equal to good plump oats. Given whole, it is difficult at times to get the birds to eat them, but trouble in this respect may be minimized by purchasing oats that are clipped, or better still, shelled. One should not neglect to give the birds an adequate supply of freshly broken oyster or other sea-shell, the lack of which is one of the causes of leg-weakness and kindred troubles which affect birds during their developing period.

The approach of the hot weather will specially direct attention to the necessity for the fowls receiving plenty of green material. This important item is overlooked on many plants, but it is all the more necessary where the birds are confined to the house or small runs. Green feed serves a threefold purpose, for it not only tends to promote good health and an increased egg yield, but also gives the yolks of eggs the desired rich colour, and a decidedly better flavour, while, further, it materially assists in reducing the grain bill and thereby makes for economic production. There is nothing better than young tender grass. Usually, however, as the season advances, any green material in the runs becomes too tough and fibrous for the birds to relish it, so that where birds are kept in confinement, and especially in bare runs, it is imperative for the maintenance of a healthy thriving state that other green food must be supplied. Silver-beet is an excellent plant to grow for poultry of all ages, and is a heavy cropper. Experience over a period of years at the Wallaceville Poultry Station goes to show that growing chickens relish silver-beet better than any other green material that can be grown on the place. Any of the cabbage family, including rape, or, alternatively, mangolds, carrots, and green oats, may be grown to advantage. A fact it is desired to emphasize is that for growing stock to make the best growth they must never receive a set-back, and one

of the worst checks to healthy development is lack of green feed during the growing stage. No effort should be spared, therefore, to grow now an abundant supply of green material for future use. Never, under present conditions, should an attempt be made to rear weaklings or deformed stock. They should never be persevered with, and it is far better to destroy them at the outset and thereby save the worry of trying to rear birds which if they do come to maturity may never pay for their keep. Remember that it is the weakly constitutioned bird which is apt to catch every passing ailment and may thus be the means of introducing serious trouble into the flock.

If the chickens being reared by artificial means are becoming weak in the legs and developing a wobbly walk, or an unsteady gait, it indicates they are crowding by night and require more warmth. The huddling effort has the effect of spreading and weakening the delicate legs. On the first sign of this condition being observed, additional warmth should be applied, but, above all, see to it that the chickens are not subjected to draughts. The latter may easily occur where brooders of the canopy type are used. In working this class of brooder, provision for the admittance of an ample supply of fresh air is imperative, but this must be provided without draughts. If there is a draught, from any particular quarter, the chicks will gradually move away from it even if it means leaving the chief source of heat so essential for their welfare, rather than remain in a draught, and when this occurs the chicks feel the need of warmth, with the result that they huddle together, each trying to secure an inside position, which is necessarily the warmest, the delicate legs spread, and the chickens become unable to walk. This trouble is intensified when the floor of the brooder is of a smooth nature, as the constant slipping on this soon injures the legs. Chickens affected with this trouble may give every indication of being quite healthy, except for the loss of leg-power, but in most cases it will be better to destroy them than to try and doctor them The removal of the cause of the trouble is the only safe course to adopt The first step in this connection is to supply the desired warmth in order that the chickens may be comfortable and may spread out over the floor of the brooder . also plenty of bedding-material should be provided. As a further preventive, a board or pieces of tin, say 15 in. in height should be placed on the floor of the house, say a foot away from the brooder, as a draught break. If the behaviour of the chicks is observed it will soon be possible to detect from which direction the draught is coming and the boards or tin used can be placed to break the draught.

It is not generally known that the lack of animal food is a common cause of brooder chicks acquiring the habit of toe picking and other cannibalistic habits. As a preventive of these troubles, the chicks should be provided regularly with animal food, but it is better not to feed it at all than to feed it only at odd periods What the chickens never had they never miss, but if once they discover the taste of meat they crave for more, which is evidenced by the fact that they commence to eat each other.

It is common when a number of cockrels are running together for them to commence sparring and fighting, often with serious results. Many a promising sire has been ruined from no other cause. A good plan is to put one or more adult males with them. This will tend to keep peace among the young birds and prevent them from injuring each other.

The Mother Hen.

Where the natural mother is being used for hatching and rearing chickens, a common but mistaken practice is to put the chicks hatched from two or more hens with one mother. This is satisfactory when poor hatches are obtained, and the numbers are not excessive, but to put twenty or more chickens with one mother is not a sound practice. It is true that the hen may rear the majority of them, or even all, but it cannot be expected that they will make such sound development as where the number has been reduced.

What applies in this case applies in equal or greater force where an excessive number of incubator hatched chicks are placed under a hen for the purpose of being reared. A case in point recently came under notice where two dozen day-old chicks were purchased and placed under one hen, obviously, from the outset, the young birds failed to thrive, and later the majority died The owner of the chicks was disinclined to take any blame whatever for his loss in this respect, but was convinced that this should be solely attached to the breeder from whom the chicks were purchased, for sending out weakly constitutioned stock. It should always be remembered that it is more profitable to rear a few chickens properly than many indifferently.

When a broody hen is being used for mothering artifically produced chicks, it will be wise to allow her to sit on the nest for at least ten days before giving her the care of the young birds. As a general rule, the longer the hen is allowed to remain broody—up til say, three weeks—the better she mothers the incubator-hatched chicks. To give a hen charge of the young birds only a day or two after her broody period has commenced invariably means that the hen does not take kindly to them, and as a result the chicks get chilled while furthermore the hen will probably resume laying in a short time, and cease to mother the chicks properly until they are able to look after themselves.

—*F C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Requeening.

THE most important bee within the hive is the queen, and it is useless to expect a colony to be productive unless she is a good one. It is therefore highly essential that all colonies should be headed with prolific queens of a good strain if vigorous workers are to be raised. Queen-rearing is an important adjunct in apiary-management, and unless provision is made to requeen systematically the beekeeper will find dwindling colonies and diminished crops. Where practicable, it is advisable to requeen the colonies every year. Exception, however, must be made in the case of hives containing breeding-queens, and others retained on account of desirable drones.

Where the operations of the beekeeper are such as to prevent annual requeening, provision should be made to replace half the queens in the apiary each year. If this plan is followed no colony will have queens more than two years old. With the aid of a few nuclei young queens can easily be hatched and mated, but in many cases—especially where a swarm has emerged from a hive—virgin queens can be secured and form an easy solution of the requeening problem.

No better plan can be followed by the beginner than to utilize queen-cells produced naturally -that is, under the swarming impulse. It has been proved that in New Zealand the best months for raising queens are from November to January. During this period everything is favourable to the operation, as the hives are at their highest state of prosperity. Under normal conditions the workers and drones are at their best, this being the swarming period. There is practically no risk of robbing; the young queens are readily accepted, and will tend to reduce swarming. Moreover, a queen introduced during the months of prosperity will produce numbers of young bees for the winter, and still be fairly young in the following spring. In the case of after-swarms, these may be sifted through an excluder placed between two empty supers, when the queen or queens can be removed. The bees will then return to the parent hive.

These young queens can be utilized for starting nuclei. It always seems a pity to destroy the young vigorous queens bred under the swarming influence, and wherever there is an opportunity they should be saved and failing queens destroyed. A handy method of introducing virgin queens is by the smoke method The old queen must first be removed from the hive that is to be requeened. The entrance then is contracted, and a few vigorous puffs of smoke are forced in through it Then, before the bees have recovered from this treatment, the virgin queen is released at the entrance, piloted into the now queenless hive, and hastened therein by several more puffs of thick smoke The hive is then closed altogether for about ten minutes, after which the entrance is once more opened slightly and left like this till the next day, when the full entrance can once more be allowed.

Extracting Preparations and Practice.

Preparations for extracting the honey must now be well in hand. By the time these notes are published the main flow should have started in the North, but it will depend entirely upon weather conditions. In the South the flow is fully three weeks later, and extracting rarely commences before the New Year.

It is well to get all the arrangements for handling the crop completed before the honey is sealed and ready for the extractor It does not take a great deal of time to prepare extra supers and frames, but these are of inestimable value to the beekeeper when the main flow commences. Every year immense quantities of honey are lost through lack of proper gear for handling the crop, or through the unreadiness of the beekeeper when the hives are full of honey It is poor economy to keep one's supply so low that the bees hang about outside the hive and loaf for want of combs in which to store the honey

Room should be provided for the workers as soon as the first honey is capped, either by extracting the combs or by supplying them with another super Keeping the extractor running from the beginning of the honey-flow till the end is good beekeeping, provided the honey is not extracted while in an unripe condition. Although some authorities advocate leaving all the honey until the end of the season—thereby building colonies three and four stories high - the result is rather heavy work, and this method is, in any case, not advisable in southern localities Where the summer is short and variable the risk of getting the honey chilled by leaving it in the hives until the end of the season is too great Honey, except in a few instances, is best extracted when warm from the hives. In fact, where there is any tendency to "thick" honey, extracting while the honey is warm is the only way to obviate breaking the combs in the extractor.

Comb-honey should be treated in the same way. All sections should be removed from the hives as soon as they are filled This makes them less liable to be daubed with the propolis and to become "travel-stained" by the constant passage of the bees.

The extractor, tank, and all the rest of the gear connected with the handling of honey should be scalded and thoroughly dried before commencing the season's work Honey, by reason of its peculiar method of production, does not call for the daily cleansing required by other foods, but it behoves the beekeeper to see that his honey-house is as trim as hands can make it. After the extractor has been scalded it should be kept covered with a clean washing cover when not in actual use, and every receptacle containing honey should receive the same treatment. These covers are easily made and washed, are inexpensive, and add much to the condition of honey as an article of food No bees, flies, or any extraneous matter should be allowed to touch the honey once it leaves

the extractor, and from the time the bees gather it till it leaves the beekeeper's hands for market his aim should be to produce a dainty and attractive article of food.

Extracting Appliances.

It is useless trying to work bees profitably without proper appliances. These consist of an extractor, uncapping-knives, uncapping-can, and settling-tanks. Many beekeepers make the mistake of trying to get along with any makeshifts, but experience will teach that it is a poor policy to endeavour to operate without an up-to-date equipment. However small the number of hives kept, if extracting is the objective it will be found to be most profitable to install a four-frame machine. Costing a little more at the initial outlay, it will soon pay for itself in labour-saving, and enable the beekeeper to meet the biggest flow. In any case he should not be persuaded to purchase a machine that will not reverse Fixed machines are labour-makers, besides being messy in working. When fifty or more colonies are worked it will be found that a power plant pays for itself over and over again.

Second in importance is a good tank No apiary equipment is complete without one or two good tanks. Too little attention is paid to maturing the honey out of the hive, and freeing it from the minute particles of wax which float on its surface It must be left to the beekeeper to decide the size of tank he requires, this depending on his needs and conveniences.

For rapid working two ordinary uncapping-knives are very convenient, but as yet no better invention has been given to the beekeeping world than the steam-heated knife. This knife obviates the necessity of constantly dipping the cold knives into hot water, and the work of uncapping can proceed uninterruptedly. There are several uncapping-cans and melters on the market, most of which are relatively satisfactory, but the perfect capping-melter has yet to be invented.

Treatment of Disease.

If the weather conditions have not been favourable for the treatment of foul-brood, such treatment should be undertaken when the first opportunity occurs. It is inadvisable to delay until the main flow arrives—if colonies are treated early enough a surplus of honey will be secured and the expense of treatment recovered. Handling clean bees is a constant source of delight, but diseased bees are a never-ending cause of trouble. Full particulars of the treatment of foul-brood are given in Bulletin No. 119 "American Foul-brood and its Treatment," which can be obtained from the Department of Agriculture, Wellington, or from the Apiary Instructors in each centre.

—E. A Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

THE month of December is a busy time among the vegetable crops. As land is released by the harvesting of early crops, a late sowing of dwarf beans, peas, shorthorn carrots, globe beet, turnips, radish, spinach, and lettuce should be sown when the land can be caught in nice moist condition without being sticky.

After clearing the ground and hoeing the surface well, plant supplies of any of the following winter crops : savoy and red cabbage, kale, broccoli, cauliflower, leeks, and celery. Good plants that are neither drawn, stunted or soft should be well watered a day or so before planting out in dull weather

or during the afternoon. This is work which should not be done roughly, but with the greatest consideration. Lift the plants carefully, place them in seed-trays for conveyance to the planting-ground, exposing them to the sun and wind as little as possible. Plant them rather deeply, firm carefully, and water them in usually, especially the leeks and celery. In exposed positions it is sometimes an advantage to plant in a shallow furrow.

It is well to realize there is a considerable battle imminent soon after these crops are planted out. White butterfly, diamond-back moth caterpillars, and green aphis usually launch a strong attack on the crops belonging to the cabbage family; while celery crops are often seriously damaged by the attack of leaf-spot fungus. The insect pests are particularly troublesome in fine dry weather when plant growth may be slow and mortality among the insects is low. Close attention is then necessary to protect the plants over the period of dry weather, after which the danger is not so great, especially from diamond-back moth and the aphides, which will possibly altogether disappear To protect the young plants from the attack of caterpillars dust them with powdered arsenate of lead one part thoroughly mixed with five parts of air-slaked burnt lime, applying it during the evening or early morning when a light dew is on the plants Green aphides, which are perhaps the more serious pest, give their attention chiefly to the bud in the centre of the plant, causing the tender leaves to curl in a way that affords them shelter and makes treatment difficult At the first sign of attack a little tobacco dust placed in the heart of each plant will make the position distasteful for the pest and migrating insects will go elsewhere to establish their colonies The celery crop is protected from the attack of leaf-spot fungus by spraying with bordeaux mixture as described in last month's notes

Reference was made last month to the harvesting of asparagus and the permanent injury done to the plantation by prolonging the cutting season beyond the usual eight or nine weeks. The results of cutting new plantations at different ages and for various periods has been demonstrated by Lewis, of Illinois, in a seven-year experiment recently concluded. Eighteen plots were planted out in the permanent field in 1926. The outstanding results for the seven years since the plants were set are as follows: A. Plots cut for two weeks the first year after planting (1927), four weeks in 1928, and the full period of eight weeks annually since totalled 431·51 lb. weight of spears for the seven years. The crop for the last year of the experiment was 133·1 lb B. Plots not cut the first year after planting (1927), but cut for two weeks the second year and four weeks the third year, with a full cutting period of eight weeks annually since, produced 531·53 lb. weight of spears. The crop for the last year of the experiment was 169·4 lb. C. Plots not cut for the first two years after planting (1927–28) and cut for four weeks the third year, six weeks the fourth year, and a full period of eight weeks for the remaining three years of the experiment, produced 467·86 lb. The crop for the last year of the experiment was 151·5 lb In this experiment the treatment given to the B series of plots gave the best return, C and A treatments following in that order. Plot A came first in the total number of spears cut, as is to be expected, plots B and C following in that order, but for the last year of the experiment the order was B, C, A, the same as for total weight. That order was also maintained for the number of first-grade spears; while B plots produced the fewest "strings" (third-grade spears), and A plots the most. For average weight of individual spears the plots remain in the same order, B, C, A. This comprehensive experiment carried out over a period of seven years indicates a light second year cutting of asparagus plantations may be advisable.

Comparatively heavy first-year cutting was included in the experiment (four weeks and six weeks), but the crop fell off badly, and permanent injury

is indicated. A four-week cutting the second year was also demonstrated, but the results are inferior to the C series of plots and little better than the A series, it is evidently a practice not to be recommended.

Tomato Crops.

Fortunately for this crop under glass, extremely high temperatures are unusual in this country, and a buoyant atmosphere is readily obtained where attention is given to ventilators at all times as necessary. A low barometer in a humid climate is probably the most difficult condition for this crop, and facilities for adequately ventilating all parts of the glasshouse are necessary if leaf-mould disease is to be controlled under such conditions.

As regards the virus diseases such as "mosaic" and "stripe," much depends on the constitution of the plants. If the constitution is undermined by a badly drained soil or poorly balanced feeding, the trouble may easily be serious, while similar infection in a well-managed crop may cause comparatively little loss. It is now well established that these diseases are often transmitted through the seed, either the embryo or seed coat, so every effort should be made to save seed only from a crop that is quite free from such diseases

The extraordinary number of plants being added to the list of those that are hosts of the "spotted-wilt" disease which also affects this crop, makes it necessary to keep a general supervision on most classes of plants growing in the vicinity, including the weeds, which should be consistently suppressed. Also thrips and sucking insects, especially those of the more active kinds, which are the chief agents for the distribution of such troubles. It is well to remember they are most numerous and active in dry warm seasons and localities.

The Homestead Garden.

Where new gardens have to be made the work is best commenced in early autumn when the ground is sufficiently moist for trenching or ploughing. When the soil is thoroughly clean and deeply cultivated, lawns may be sown and planting done Then the best results are obtained quickly if the design is well proportioned and the trees and shrubs carefully selected and arranged.

To do this satisfactorily the undertaking requires consideration, which should be given it now, so that a definite plan is ready when the time for action arrives. The plan for the layout need not be elaborate, but should be to scale, as also should be the arrangement of the planting.

During the spring we have had groups of the Chatham Island lily in sheltered shady positions making a fine display of blue flowers and handsome foliage. In a good moist loam the kowhai makes a light graceful tree, and the quality of its ample yellow blossom has made it a general favourite. The kaka beak—sometimes called kowhai—red, pink, and white, is making a display on sloping banks where its pendulous flowers are seen to advantage. On almost every hand a mantle of the starry white blossoms of the native clematis has been spread on the boughs of evergreen trees to remind us that October is here. In the most exposed places veronicas, red, blue, and white, grow best, and are now taking their place in the procession. These and other native flowering-plants, together with our tree ferns and palms, should receive the consideration of every planter; as should the great number of handsome native evergreens which are not to be excelled for the purposes of shelter under many conditions, and provide the necessary setting without which the brighter flowering plants lose half their beauty. Not that exotic trees and shrubs should be ignored; such a setting as is mentioned above is ideal for the hydrangeas, which have been so improved during recent years, and provide a generous display when most shrubs have passed their blossoming season. What is to be said of rhododendrons and azaleas which flower here in a manner which

is probably unsurpassed in any country ? It is rare to see these grouped to best advantage in semi-shade where they thrive best ; a good deal of consideration is necessary to do this effectively.

The chief difficulty in this problem is the "embarrassment of riches" provided by the long list of good things available and the rather natural desire to plant a specimen of each, so far as possible , with the result that the garden loses the repose and brightness which should be its outstanding qualities. Restraint is essential to good design If this rule is observed when planning garden-planting there will be less variety and rather larger grouping, especially in the smaller subjects The resulting effect should far outweigh any sacrifice of variety that has been made

Alterations as well as new gardens should be planned now

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COLDS IN PULLETS.

C. R. R , Te Tuhi, Hawke's Bay :—

Twelve pullets are affected with eye trouble As a rule only one eye is affected, but sometimes both Sometimes the eye is light-grey with a film, but more often it has a bloodshot look and is very covered with film, inflamed, and tender Some hens in an advanced stage are quite blind in one eye I have isolated the birds, and have tried a lotion with boracic and sulphate of zinc, but with no effect

The Live-stock Division : -

The birds are suffering from roup, due to a neglected cold. Colds are most commonly caused through compelling the birds to sleep in an ill-ventilated or draughty house, while exposure to rain, and damp, overcrowded quarters are often responsible There are so many things which may be responsible for fowls catching cold, the forerunner of roup, that it is usually necessary to look for the cause in several quarters Even where the modern, deep, partly open-fronted, lean-to style of house is provided, the poultry-keeper must be always on the alert to make sure that, while good ventilation is provided, the birds are not sleeping in a draught Even one small crack close to where a bird is roosting may cause much trouble. Prevention in dealing with colds is always better than remedial treatment ; but when colds have made their appearance, treatment may be found necessary. Prompt measures should be taken, for too often the neglected cold, as previously indicated, develops into the dangerous roup. When this stage has been reached, little or nothing can be done for the bird, and usually the best course is to kill it and burn the carcass. A little Condy's fluid placed in the drinking-water, sufficient to give it a rich pink colour, will generally prove effective in checking the trouble.

MARE PREMATURELY SECRETING MILK.

T. M. W., Warkworth :—

A nine-year-old mare due to foal in three months has quite a show of milk. On her back legs you can notice where there appears to be milk or scum dripping from her udder. The mare is in good condition and does no work at all. She appears quite healthy, and trots around the paddock.

The Live-stock Division :—

This will sometimes happen in extraordinary cases, and if her udder is much distended it would be better to relieve it Is there any sign that she has cast her foal ? If so, then she would secrete milk.

USE OF OLD DIPPING FLUID.

S. P. B., Fairlie :—

Dip is in a reasonably clean condition and has been standing in the bath since last April. Would it be harmful if used for dipping sheep a second time now? The fluid has not been polluted in any way, save for the dipping of a certain number of sheep just before the winter Would standing so long tend to weaken it and, if so, to what extent?

The Live-stock Division :—

One cannot recommend the use of this dip. During the time it has been standing deterioration must have taken place, also dilution by rain-water, &c., and, further, the fact that the excrement—*i.e.*, dung and urine from the previously dipped sheep—has been in the dip for so long must have caused pollution

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DISCHARGE AFTER DEHORNING.

W. H., Helensville :—

One of several heifers which were dehorned last April has failed to heal on one side, from which there is a discharge of thick white fluid. What treatment should I give it?

The Live-stock Division :—

One can do very little for this except to syringe out the cavity with any antiseptic solution every day. I would advise you to use hydrogen peroxide diluted with warm water, one of the peroxide to three of the water. Do this daily for a time, and if there is no improvement after a fortnight's treatment it might be better to fatten and sell the heifer.

MACROCARPA POSTS.

W. H. S., Wanganui :—

(1) Is it necessary to season macrocarpa posts before using? (2) Is it necessary to take off the bark; and will it cause the "heart" to rot if the sapwood is left on saplings and branches? (3) Will macrocarpa sapwood last out of the ground?

The State Forest Service :—

(1) It is unnecessary to season posts of any species before using. If posts are seasoned they immediately reabsorb moisture from the damp earth in which they are placed, and no merit, therefore, attaches to seasoning before use (2) To obtain the best life out of posts, it is necessary to remove the bark and sapwood. The sapwood of all species is non-durable, and will quickly rot in the ground. It may not necessarily affect the heartwood, but will certainly not aid its preservation. (3) Whether or not macrocarpa sap will last out of the ground depends entirely on the conditions under which it is used; and, in general, it can be stated that the sapwood of this species is not superior to that of other species in this respect. Sapwood out of the ground in dry locations may last for a long period of years, but, as stated, conditions of its use will govern its durability.

DURABILITY OF BIRCH POSTS.

A. H., Gisborne :—

I understand that for fencing-posts one of our birch (beech) trees is almost as durable as totara.

The State Forest Service :—

Red-beech (*Nothofagus fusca*) is the most durable beech species for fencing-posts, but it is not considered by any means as durable as totara (*Podocarpus totara*).

WEATHER RECORDS: OCTOBER, 1934.

Dominion Meteorological Office.

NOTES FOR OCTOBER.

WITH the exception of the first two days, October was very mild and equable. There was much less westerly wind than usual at this time of year. Conditions are rather dry in the eastern portions of the North Island, but in Nelson, Marlborough, and Canterbury the subsoil is thoroughly soaked for the first time during the last four to five years. Over the rest of the country, though rainfall has been on the light side so far this year, there is no acute shortage. On the whole, October was one of the best spring months we have had. There has been a wonderful flush of growth in grass and vegetation generally, and the countryside has never looked greener. Stock are in good condition, although in some districts lambs have not thriven as well as might be expected. The prospects for fruit and other crops are very good. Some trouble has been experienced in parts of Canterbury and Marlborough from excessive moisture.

Rainfall.—In Taranaki, Western Wellington, Nelson, Marlborough, and Canterbury rains were, in general, much above the average, though there were a few exceptions. Wellington City and much of Marlborough had double the normal total. In Westland the falls were for the most part about average. The remainder of the country received much less than is usual in October.

Temperatures.—After the 2nd, the month was a very mild one with no prolonged or severe spell of cold southerly wind. Nevertheless, mean temperatures were almost everywhere below normal. The departures were fairly large on the east coast but very small on the west.

Sunshine.—As regards sunshine, conditions were very irregular. Considerable departures from the average were recorded at numbers of places, but excesses and deficits appear to be about equally mixed. Lake Tekapo had 246·5 hours, Napier 220·1, Tauranga 215·5, and Blenheim 211·7.

Storm Systems.—The only storm of note occurred at the beginning of the month. At this time a depression was crossing the Dominion, and on the morning of the 2nd a deep cyclone centre developed over the Cook Strait area. Rain was practically general, and in the western and central districts there were many heavy falls. Flooding occurred in Taranaki, Southern Wellington, Marlborough, and North Canterbury. On the 1st, northerly gales raged at many places from Nelson and Marlborough northwards, and the Wairarapa experienced the most destructive gale in its history. The reason why this wind was so damaging is not very clear, since, in the higher levels, and at Wellington, for instance, stronger blows have been recorded. It must, however, have descended with unusual force to the low levels after crossing the Tararua Ranges. Such a descent is favoured if the ground is unusually warm, and the fact that the night of the 30th September to 1st October was unusually warm at Wellington while a very high maximum temperature was recorded at Masterton is in accordance with this. A strong southerly wind and a sharp cold snap followed on the 2nd October, and snow fell to low levels on the ranges.

A moderate westerly depression which passed on the 9th was also responsible for a fresh fall of snow on the ranges, but the precipitation caused by it was far from general.

On the 12th, another depression moved on to the country, and, its further movement being checked by an intense anticyclone to the eastward, did not disappear until the 16th. During this time rain fell in all parts, but was particularly heavy on the mountains and in western districts.

Several other depressions passed during the month, but none was very boisterous or productive of general rain. Associated with one of these there were some severe thunder and hail storms in western districts of the North Island on the 31st.

RAINFALLS FOR OCTOBER, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.	Total for Year to Date.	Average for Year to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches
Kaitaia	5·12	14	1·87	5·27	53·69	48·93
Russell	2·38	8	1·25	3·98	69·44	45·17
Whangarei	3·26	17	1·00	4·76	54·31	54·71
Auckland	2·17	14	0·75	3·72	39·99	38·68
Hamilton	2·90	15	1·00	4·60	36·26	42·03
Rotorua	4·42	17	1·17	5·27	43·57	47·10
Kawhia	4·71	18	1·20	5·15	41·22	45·90
New Plymouth	6·94	17	2·10	5·48	46·51	50·80
Riversdale, Inglewood	11·56	19	4·46	10·41	71·60	87·57
Whangamomona	12·99	13	2·00	8·43	57·22	64·53
Hawera	3·42	12	0·72	4·65	33·54	38·18
Tairua	3·43	10	1·15	5·81	49·61	56·44
Tauranga	3·23	13	0·73	5·26	47·75	45·55
Maraehako Station, Opotiki	2·50	10	0·72	5·35	38·52	47·29
Gisborne	1·09	10	0·53	2·07	23·31	39·95
Taupo	2·61	17	1·56	4·31	34·66	37·43
Napier	1·67	13	0·33	2·19	24·50	30·41
Hastings	1·54	13	0·43	2·11	21·38	28·16
Whakarara Station	1·74	9	0·51	..	41·31	..
Taihape	2·39	17	0·42	3·60	25·75	30·22
Masterton	2·04	10	0·83	3·28	30·03	32·04
Patea	6·21	..	..	4·25	35·53	37·28
Wanganui	3·43	13	1·07	3·46	29·17	30·18
Foxton	5·41	14	0·88	2·94	29·18	26·67
Wellington	6·85	14	2·23	3·41	41·13	35·34
South Island.						
Westport	9·48	22	1·31	8·70	76·86	79·50
Greymouth	11·25	20	3·90	10·74	82·44	83·80
Hokitika	10·62	19	2·69	11·86	82·43	94·11
Ross	..	..	..	14·77	..	109·58
Arthur's Pass	19·08	10	4·70	20·33	142·09	131·69
Okuru, South Westland	9·84	12	2·70	15·21	..	120·90
Collingwood	9·35	17	1·97	10·08	81·37	82·03
Nelson	6·20	13	1·51	3·51	32·82	31·93
Spring Creek, Blenheim	5·49	10	1·43	2·56	29·17	25·79
Seddon	4·76	10	1·55	2·23	26·73	20·99
Hanmer Springs	5·02	10	1·42	3·93	46·47	37·90
Highfield, Waiau	3·81	9	0·88	2·60	33·00	28·12
Gore Bay	3·55	13	0·82	2·33	35·76	26·58
Christchurch	0·96	10	0·26	1·75	24·81	20·94
Timaru	2·92	10	0·73	1·95	24·25	18·30
Lambrook Station, Fairlie	3·55	9	0·91	2·06	27·26	20·37
Benmore Station, Clearburn	2·90	13	0·77	2·30	22·45	20·25
Oamaru	2·62	13	0·70	1·76	22·33	17·84
Queenstown	2·36	7	1·01	3·37	29·95	25·16
Clyde	0·91	5	0·29	1·62	14·79	12·12
Dunedin	1·83	12	0·69	3·10	37·02	30·03
Wendon	1·16	8	0·29	2·73	23·88	24·42
Balclutha	0·84	11	0·21	2·42	28·06	20·58
Invercargill	2·53	17	0·80	4·42	34·58	37·30
Puysegur Point	5·62	17	1·65	8·13	59·24	69·84
Half-moon Bay	2·73	19	0·47	5·16	40·96	48·10

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THE CONTROL OF THE GRASS-GRUB *(ODONTRIA ZEALANDICA)* IN SMALL AREAS.

W. COTTIER, Assistant Entomologist, Plant Research Station, Palmerston North.

THE following account has been prepared for those who are troubled with the grass-grub in relatively small areas, such as lawns, playing-areas, nurseries, gardens, &c.

Treatments that can be adopted for each are given under appropriate headings below.

DESCRIPTION OF THE STAGES OF THE GRASS-GRUB.

The adult ("A" Fig. 1) is commonly called the brown beetle on account of its colour. It is a typical beetle with two hard wing cases on the back, the whole insect being approximately $\frac{3}{5}$ in. long.

The spherical egg is minute and white, and is approximately the size of a pin-head.

The larva or "grub" ("B" Fig. 1) is white and when found is usually curled up in a semicircle. The head is brown and the hind part of the abdomen is usually dark in colour and somewhat swollen in appearance. When fully grown the grub is approximately 1 in. long. The pupa, when first formed, is white, but soon deepens to brown, and is approximately $\frac{1}{2}$ in. long.

LIFE-HISTORY AND HABITS.

The adult beetle is on the wing during the latter part of October and during November, December, and sometimes into early January. It is most abundant during late November and early December. During the day the beetles hide beneath vegetation on the ground or burrow a short way into the soil and take to the wing just at dusk, making a conspicuous droning noise that is quite characteristic. These flights take place close to the ground and occur most commonly on warm "muggy" evenings, cold and wet conditions exercising an inhibitory influence. Feeding is carried out at night, favoured hosts being the stone fruits such as peaches and nectarines which are frequently entirely stripped of their leaves, while whole fields of cruciferous crops in the seedling stage are frequently destroyed. The foliage of willow trees is another favoured host.

When the adult female enters the ground it does so not only for refuge, but also to lay its eggs about ½ in. to 1 in. below the surface, among the roots of suitable vegetation. In about ten days these eggs hatch and produce the characteristic white grubs which, of course, are at first very small. Feeding and growth rapidly

FIG. 1. A, GRASS-GRUB BEETLE. B, GRASS-GRUBS.
(Both much enlarged.) [Photo. by H. Drake.

take place, and by February the presence of the grass-grub is usually only too plain. It is characteristic of this pest that it causes damage to vegetation in patches, such patches probably being selected for egg-laying because they are softer and easier for the beetle to burrow into than are the harder and stiffer

surrounding areas, or else the patches occur where the swarms of beetles settle and lay their eggs. By April or May the damage has reached its maximum, and especially in the dry season great havoc may be wrought. When winter comes on, the grubs burrow down into the ground to a deeper level to escape the cold as much as possible, although in the warmer climates great numbers can usually be found still feeding at the surface all through the winter. While sheltering from the cold the grubs construct smooth walled, more or less round, earthen cells in which they lie in a curled up position. They remain here in a three-quarters grown state until the warmer weather of August causes them to resume their activities. Grub damage at this time, however, is almost negligible compared with that which is caused in the autumn, the grubs diminishing greatly in concentration during the winter. By September and October the grubs are full-grown and descend again to transform to the pupæ which are contained in smooth walled earthen cells. During the latter part of October and during November and even December the adult beetles make their way out of the ground to commence the cycle again.

Grub-control in Lawns and Playing-areas.

The available methods of control can be conveniently divided up into two classes :—

(1) "Temporary" by which control of the grub is secured for one season only.

(2) "Permanent" by which control is secured for several seasons.

(1) TEMPORARY MEASURES.

*(a) Carbon Disulphide Injection Method.**

Measured quantities of carbon disulphide are applied to the area of infestation by means of holes 3 in. to 4 in. deep. The holes should be spaced at intervals of 1 ft. The quantity of carbon disulphide to be applied varies with the nature of the soil. If it is of a sandy nature ⅕ to ¼ fluid ounce per hole is sufficient, but where the texture is heavier ⅓ fluid ounce is necessary. It is advisable to avoid contact of the liquid with the grass, and plug each hole immediately following application.

Application is simplified by the use of an injecting-machine (Fig. 2). The apparatus consists of a zinc or copper cylindrical container attached to a long hollow cast-iron spike with a conical extremity. Two handles are provided for holding the apparatus in position and with the aid of an attached pedal the hollow spike is driven to the required depth in the soil. Inside the instrument is a pump fitted with a piston. On depressing the rod of the piston, which projects above the handles, a valve opens and a measured dose of carbon disulphide is projected into the soil through an aperture at the end of the hollow tube. The hole made in the turf must be blocked up immediately to prevent evaporation of the chemical into the air. With this instrument 6 c.c. (approximately ⅕ to ¼ fluid ounce) per hole in light sandy soil and 10 c.c.

*** Carbon disulphide should be handled with care, as it is inflammable, poisonous, and explosive.**

(approximately ⅛ fluid ounce) per hole in stiffer soil will be required for each injection. In "grubby" areas, the possession of one of these instruments will prove to be a real asset.

(b) Carbon Disulphide Emulsion Method.

Where the carbon disulphide has to be injected other than by machine it will usually be found that there are small browned areas of grass surrounding the lip of each hole, caused through the spilling of the chemical. This may appear undesirable in the eyes of some. To overcome this and to avoid making holes in, for example, a golf-green, an emulsion of carbon disulphide may be used. Such an emulsion that has been found to be very satisfactory is one where a well emulsified coal oil has been used—viz., "Restar." The formula, expressed in parts by volume, of the stock solution is as follows: Carbon disulphide, 7; water, 7; "Restar," 1.

The primary emulsion is made by shaking together vigorously the carbon disulphide and "Restar" until a thick cream is formed. Finally, the water is added. A good test for a satisfactory emulsion is to see that the carbon disulphide does not separate out on dilution. For use, 1 part by volume of this stock emulsion must be diluted with 135 parts of water, and by means of a watering-can this must be applied to infested turf at the rate of 3½ gallons per square yard of surface.

It is most important to see that the material does not lie on the surface of the ground, for if even the slightest puddle is allowed to form, damage will result. For this reason application must be made very slowly, only such a quantity of emulsion being applied at a time as will soak in immediately. Where the liquid does not soak in readily, the turf may be lifted and loosened with a fork.

(c) The Coal-tar Distillate Method.

The coal-tar distillate used (*e.g.*, "Restar") must be thoroughly emulsified to form a white emulsion with water. The material is used at the rate of 1 part of coal-tar distillate to 150 parts of water by volume. Application is made by means of a watering-can at the rate of 3 gallons per square yard of infested turf. It is very important that this mixture be applied slowly so that no puddling takes place, and for this reason the operator will most likely find it convenient to use the fork to loosen up the turf. After the material has soaked in, 3 gallons of clean water per square yard must be applied *immediately*. This is necessary to wash the emulsion off the grass, otherwise severe burning will occur. It will be found convenient to treat about 2 square yards at a time, and while the 3 gallons per square yard of clean water are soaking in on this plot which has already had the distillate applied to it, another 2 square yards can be treated with the emulsion, and so on.

(d) The Naphthalene Method.

This method is applicable only to fallow ground because the material is a solid which must be worked into the soil. Therefore it is useful only in cases where soil is being prepared for sowing down to turf, &c. Naphthalene (free from tar) is the best material to use, and should be applied by digging the material about 3 in. into the loose

fallow soil at the rate of 3 oz. per square yard. The area should not be sown until at least a month after the application of the insecticide.

This material and its related proprietary mixtures are of no use on formed turf.

(2) PERMANENT MEASURES.

These involve the use of arsenate of lead powder as used for spraying fruit-trees. Our experiments have shown that this method will keep turf free from grub for several seasons. It differs from the methods described above in that it acts more slowly for immediate control, but once it is in the ground it acts as a preventive against subsequent infestations.

For areas such as lawns ¾ oz. of arsenate of lead powder per square yard of surface should be used. The required quantity should be thoroughly mixed with about twice its volume of slightly moist (not wet) fine soil or sand and broadcast evenly. It is a good idea to rub the material well in with the back of a rake. For large areas such as fairways the arsenate may be reduced to a minimum of ⅜ oz. to ½ oz. per square yard.

After the arsenate has been laid down for at least a month it is a very good plan to give the treated area a thorough dressing with a good manure mixture (see below). Application should not be made while the grass is wet as under these conditions a quantity of arsenate will stick to the leaves and may not subsequently enter the soil.

In the case of a lawn that has just been seeded down, grub-proofing may be carried out as follows: Apply the arsenate (¾ oz. per square yard) and soil or sand mixture broadcast, but only when the grass is strong and the turf fairly firm, otherwise, in loose soil, the powder will easily be washed down and distributed over such a wide area that the concentration of the poison in the top layer is insufficient to kill grubs that might enter subsequently.

Another method of grub-proofing in such a case is to work thoroughly into the prepared ground before seeding, 1½ oz. of arsenate per square yard so that when the turf is finally formed the poison will extend through the top inch.

To grub-proof pieces of turf used to replace damaged ones, such turfs should be thoroughly soaked in a suspension made by mixing arsenate of lead with water at the rate of 3 lb. to 12 gallons.

RECOMMENDATIONS.

The quickest method of eradicating the grass-grub for one season is by the use of carbon disulphide, either using the injection method or the emulsion. When it is desired to destroy the grub where it is infesting only small patches in an area of lawn or other turf, this method is the most suitable. For this reason carbon disulphide always should be kept on hand where the turf is in a region that is subject to damage by the pest.

Where it is impossible to secure carbon disulphide, then the coal-tar distillate method may be used. It must be understood that this latter method at best is only a substitute for the former, and that it requires very careful handling to get satisfactory results. It should never be used on turf that will not allow the liquid to soak in

quickly without leaving puddles, as the grass is liable to be browned off temporarily. When it is used on suitable ground, however, and when the directions are followed to the letter, excellent results may be secured. There may be a little browning which should disappear in a month, but the grass will subsequently "come away" in excellent condition.

As stated previously, the naphthalene treatment is suitable only for fallow ground.

The arsenate of lead method is one that gives great promise, since it is easy to apply to even large areas, and when it is remembered that the poison remains efficient for several seasons, in the end it will prove to be the cheapest of all. Lawns, greens, and fairways can be protected completely and good playing-areas will be assured.

MANAGEMENT AS AN AID IN PREVENTING GRUB DAMAGE IN TURF.

There are several points that should be kept in mind concerning grub attack. One is that lack of moisture will aggravate the trouble, in that damaged plants are unable to draw moisture from below, because the grub has eaten through the roots and produced a layer of pulverized soil close to the surface through which capillary moisture is unable to move readily. To remedy this the roller should be used freely and on areas such as lawns and greens a reasonable supply of moisture should be maintained.

Another point is that the greatest concentrations of grubs are nearly always found in light, loose ground, because these conditions allow the female beetle to burrow in easily and lay her eggs. This points to the desirability in grass-grub areas of making prepared pieces of ground such as greens and lawns of as heavy a texture as is consistent with good condition of the turf. Another point that comes from this consideration is that, if practicable, turf should be kept as compact as possible by frequent rolling during the egg-laying period of the beetle in November and December.

The final point that should be borne in mind is that grass-grub damage can at least be greatly lessened by keeping the turf so strong, that, although grubs are present, damage may not be apparent. In this connection the use of suitable manure mixtures is almost sufficiently obvious to require no elaboration.

As it will be of interest to many readers to know just what manure can be recommended for general use on lawns Mr. E. A. Madden of this Station has kindly supplied the following particulars. For spring and autumn use the following mixture: Superphosphate, 1 part; sulphate of ammonia, 1 part. For summer use or in dry periods use the following: Superphosphate, 1 part; nitrate of soda, 1 part. Both are for use at the rate of 1 oz. of the mixture per square yard.

When the grub has been very severe, the grass should be manured every two to three months at least. Where weeds and clover are plentiful and it is desired to eliminate these the following mixture may be used in the spring and autumn but not in the summer. Superphosphate, 1 part; sulphate of ammonia, 2 parts; sulphate of iron, 1 part. This is for use at the rate of 1 and $\frac{2}{3}$ oz. per square yard.

Grub-control in Nursery Areas and Gardens.

The methods that are at present available for the destruction of the grub in areas such as these are:—

(*a*) *Carbon Disulphide* is the most efficient material that can be used, and if injected with the apparatus shown in Fig. 2 the operation can be carried out relatively quickly. If infested plants are in rows, an injection of 6 c.c. (approximately $\frac{1}{5}$ to $\frac{1}{4}$ fluid ounce), should be made at least 3 in. deep every foot. If the soil is hard and "clayey" 10 c.c. (approximately $\frac{1}{3}$ fluid ounce) per injection will probably be required. All holes must be covered in immediately the chemical has been introduced. Care must be taken that each injection is made

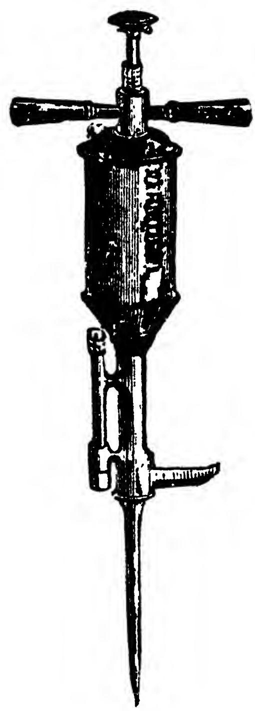

FIG. 2. CARBON DISULPHIDE INJECTION APPARATUS
(After Wardle and Buckle.)

2 in. to 3 in. away from any plant, as the raw material in direct contact with any vegetation will injure it. If an injector is not available, then the holes can be made with a stick or some other suitable instrument and the required quantity of carbon disulphide poured into each hole, after which operation the hole is immediately closed. This operation is tedious and somewhat difficult and quicker progress can be made with the carbon disulphide "Restar" emulsion described above. If the plants are in rows this emulsion should be applied with a watering-can at the rate of $3\frac{1}{2}$ gallons every 6 yards, making the treated strips 6 in. wide. If the plants are in beds, apply

the material at the rate of 3½ gallons per square yard. Application in all cases should be made slowly so that the liquid soaks into the ground as soon as it is put on—if any puddling is allowed damage is liable to result. After the emulsion has been applied it is a good plan to give the plants a thorough sprinkling with clean water, although we have found that with this last operation omitted no injury usually results to plants hardy enough to grow during the winter. Care must be taken to emulsify the carbon disulphide properly or damage will most probably result.

(*b*) *Naphthalene and Related Preparations.*—Most solid soil-fumigants derived from the distillation of coal depend on this constituent for their efficiency Naphthalene is useful really only in infested ground that can be dug up for treatment or where it can be worked close in to the roots of infested plants. For such areas use at the rate of 2 oz. to 3 oz. per square yard worked thoroughly 3 in. to 4 in. deep into the soil. Preparatory to planting, treated ground should be left three to four weeks.

Our experiments on the use of arsenate of lead as a "permanent" measure against the grass-grub in nursery areas are not yet definite enough to allow recommendations to be made.

MANAGEMENT IN NURSERY AND GARDEN AREAS.

Fallowing of infested ground or ground likely to be infested is a valuable method of overcoming or avoiding grass-grub attack. In large areas the cost of chemical treatment is often too great for the average man, and the only means left to him lie in proper management of his land.

Our knowledge of the habits of the grub allow us to recommend certain practices as beneficial in reducing injury. An outline of correct management for the purpose of avoiding grub injury is given below and the discussion is mainly grouped under two headings according to the plants infested, whether annuals or perennials.

Annuals: For the purpose of discussion these can be formed into three groups.

(1) Spring-sown plants liable to infestation from the previous season's grubs and also liable to infestation by grubs which hatch from eggs deposited by the beetle after the plants are in the ground.

(2) Plants sown between spring and autumn and liable to infestation by grubs hatching from eggs deposited by the beetles in November and December.

(3) Autumn-sown plants liable to infestation from grubs which have been feeding on plants that occupied the ground during the summer.

Ground that is to be used for plants of group (1) should be ploughed or dug several months before it will be required for planting and in the interval should be cultivated thoroughly, if possible, once every ten days. This operation will kill many grubs by mechanical action and a large number will be exposed to birds. If the ground has been broken out of grass it should be left fallow

until October for as long as possible and great care must be taken to cultivate it thoroughly at frequent intervals. Naturally, it is important to keep fallowed ground as free as possible from all vegetation. In grass-grub country the setting-out of susceptible plants in the spring in land that has been broken from grass immediately prior to planting is simply asking for trouble. Unless the fallowing above described can be carried out, it is far better to plant such areas in the spring to some "cleaning" crop such as potatoes or some other root crop or a non-susceptible crop such as cabbage or cauliflower. Thus a season of clean ground carrying a non-susceptible crop will pass before the susceptible plants are put out the next spring. Of course, the ground carrying the "cleaning" crop must be kept free from weeds.

For plants of group (2) fallowing is also of great importance and should be carried out for as long as possible before the planting, frequent thorough cultivation being made at weekly or ten day periods. The reason for such fallowing is to prevent the beetle from laying its eggs, the bulk of these being laid in November and December. The reason for the cultivation is to help to keep down weeds and to destroy grubs that may possibly have hatched from any eggs deposited.

For plants of group (3) fallowing is again important, and should be carried out over the egg-laying period of the beetle. The ground during this period should be kept absolutely free from all vegetation or else it can be sown to a good "cleaning" crop such as potatoes, &c., or some other non-susceptible crop so that when the autumn comes the ground will be free from grub. In grass-grub country it is much more important for autumn-sown plants than for spring-sown plants that the area used should not be broken from grass immediately before planting. Such ground should really be broken before the preceding November and put down to a non-susceptible crop.

Perennials: The above remarks on annuals are also applicable to perennials in their first year. Later on, however, not a great deal can be done if the area is too big for chemical treatment. However, the ground should be kept free from weeds at all times. The application of a light dressing of naphthalene, say 2 cwt per acre, worked lightly into the ground at the beginning of November and as close to the plants as possible will help to stop re-infestation. This is applicable to annuals also. Care must be taken not to dust the naphthalene on to the plants, otherwise browning is liable to occur. In the case of plants showing signs of distress from grub attack it is often possible to shift them to clean ground. Before replanting, however, as much soil as possible should be removed from the roots which should then be soaked for half an hour to an hour in arsenate of lead suspension made at the rate of 4 lb. to 5 lb. of arsenate to 100 gallons of water. This will help to guard against subsequent attack.

A fact that must be borne in mind is that where host plants are present suitable for the feeding of the adult beetle, grubs are likely to cause subsequent damage. For this reason it is unwise to have hosts such as stone-fruits and willows or early planted turnip or rape crops

adjacent to areas containing plants susceptible to the grub. If the presence of such hosts cannot be avoided and it is possible to spray them, use arsenate of lead at frequent intervals at the rate of 2 lb. to 3 lb. per 100 gallons of water. In this connection, however, it must be remembered that stone-fruits will not tolerate a dose of arsenate at a greater strength than 1 lb. per 100 gallons applied at comparatively long intervals. For such susceptible trees it is best to use a spray consisting of 1 lb. arsenate of lead + 3 lb. hydrated lime per 100 gallons of water.

It is to be remembered, too, that the more vigorous a plant is the greater will be its ability to withstand grass-grub attack. In this connection the use of suitable manures is obviously desirable and often the ready application of a quick-acting manure in the presence of plenty of moisture will work wonders in lessening the effects of grub attack.

Further, a plentiful supply of water and the conservation of the moisture in the top layers of the soil greatly assist a plant to withstand grub attack. The greatest damage is usually caused by the pest when it is feeding vigorously and there is a scarcity of moisture.

Finally, the grass-grub shows a decided preference for light soils and the growing of susceptible plants on heavier land, if possible, will tend to reduce injury.

When the above remarks on nursery management are read it should be borne in mind that such remarks describe what is considered to be more or less ideal management as far as the prevention of grub damage is concerned. Many might find it impossible, for instance, to leave valuable ground fallow for a comparatively long period and of course their programmes will be determined accordingly. Nevertheless, the nearer that management follows along the ideal lines described above so much less will be the likelihood of injury caused by the pest.

GRADING OF MILK.

The grading of milk with differential payments according to grade, which was introduced during the previous season, so improved the quality of the milk-supply to cheese-factories that it was deemed advisable to frame regulations making compulsory payments for two grades, first and second, giving companies the option of making payment of a higher grade with a higher payment. It was further decided to apply the grading to milk supplied to butter-factories, that the grades be three, as in the case of cream grades—viz., finest, first, and second—and that the grading of milk for cheese-making be based on the curd test in conjunction with either the reductase test or microscopic test, and of the milk for butter-making on either one of these tests or the curd test together with the reductase or microscopic test. These regulations came into force as from the 1st August, 1933.

The curd test and reductase test are almost exclusively used, and are operated on the factory premises by the certificated milk-graders. By means of the curd test it can be demonstrated to suppliers of poorer quality milk that the quality is as indicated by the grade, and in many instances steps have been taken to effect the desired improvement.

Cheese-factory managers are unanimous that this method of grading is on sound lines, and the consensus of opinion is that the quality of the milk generally has been raised to a higher standard. This is reflected in the improved quality of the cheese output for the year.—*Report, Director, Dairy Division.*

SHEEP-DIPPING.

W. T. COLLINS, District Superintendent, Live-stock Division, Auckland

AMONGST the many activities associated with the management of sheep, dipping is one of the most important and yet one that does not receive the attention it should, but is often carried out in a more or less perfunctory manner. That it is important to have a flock free from external parasites cannot be gainsaid, for if sheep are infested with vermin, such as ticks and lice, they cannot be expected to thrive well and fatten or produce good wool.

Sheep suffer severely when infested with ticks or lice. These parasites attack the skin, and by their operations produce great itching, which causes the animal to gnaw itself, scratch, and rub against fences, &c. At the places where the parasites are most numerous the skin gets badly inflamed, partly due to the efforts of the animal to remove them, and partly to the attacks of the vermin themselves, with the result that the wool is pulled out, matted, or blood-stained. The severity of the itching depends on the degree of infestation. Sheep, as a rule, suffer more severely from attacks by lice than by ticks, as the lice multiply very much more quickly and are found in greater numbers. Any animal infested with ticks and lice soon loses condition and becomes weak.

In this country several external parasites attack our flocks. The ked, or, as it is more commonly called, the sheep-tick, is probably the best known. There are three species of lice: the body louse that is found in various parts of the body, but most commonly seen in the brisket and neck; the face louse, seen chiefly in the face of the sheep; and the leg louse, found chiefly in the hair of the legs below the knee and hock.

The ked or sheep-tick should not be confused with the cattle-tick found in parts of the Auckland Province. It can be distinguished by the fact that the ked, which can be described as being a wingless fly, has six legs, whereas a fully grown cattle-tick has eight legs. The life-history of the ked is also totally different from that of the cattle-tick; the former spends the whole of its life on the host, and if by any chance it falls off it will live only a few days. On the other hand, the cattle-tick drops off the host and lays its eggs in the ground, where they hatch out, and the young ticks may live for months without feeding.

The ked is probably well known to all sheep-farmers, as it is so commonly found on most flocks. A full-grown specimen is about $\frac{1}{8}$ in. in length, and, being dark in colour, is easily found in the wool. Although in some flocks the ked is found in large numbers, it is not as prolific as some species of vermin. The female brings forth only one egg or pupa at a time and only four or five in the course of a year. These eggs or pupa are small oval bodies not unlike a small apple pip and are found firmly attached to the wool. Each pupa contains an embryo ked and in about three weeks from the time they are deposited by the female, the end opens out and the young ked emerges.

Lice, which are very much smaller than ticks, are of a dull white colour. Hence it is very difficult to find them in the wool. They

are much more prolific than the ked and therefore the infestation is usually much heavier. The eggs, usually called nits, are small and pear-shaped, and have a cover or lid at one end and are found firmly attached to the wool. The young, which leave the eggs when the cover opens, are in all respects the same shape as the adults.

As neither the ked nor lice live long after leaving the host, the chief method by which clean sheep become infested is through coming in contact with already infested animals. This is more likely to take place when sheep are penned up together or in camps where they come in contact with each other. Mobs are also likely to become infested at sale-yards for, although the sheep are not actually penned up together, usually they are separated only by a few rails or a wire fence, and therefore the wool of sheep in one pen can come in actual contact with the wool of sheep in the adjoining pen and so the vermin can transfer from one mob to the other. Another method by which a flock may become infested with these parasites is the all-too-common practice of drovers leaving on the road or putting over the fence tired sheep out of the mob they are driving. These sheep are usually weak ones and liable to infestation with vermin, and they in turn infest the sheep with which they are placed. To clean a flock successfully it is essential that all sheep be properly dipped. Stragglers are sometimes left behind at mustering because they are too weak to keep up with the stronger ones, and such stragglers may be a fruitful source of infection.

To free a flock from vermin it is absolutely essential that it be properly dipped and not, as appears to be done in some cases, put through a dipping-bath simply to comply with the requirements of the Stock Act. It is a waste of money buying dip and a waste of time mustering and putting sheep through a dip unless the dipping fluid is made up just as laid down by the makers of the particular dip being used, and all details as to time of immersion, &c., are carried out to the letter. Many owners blame the dip when they fail to get results, but it can be said safely that in the great majority of cases, if not all, the fault lies with the dipper and not with the makers of the dip. The Stock Act lays it down that all longwool and crossbred sheep shall be dipped each year in the North Island between the 1st January and the 31st March, and elsewhere than in the North Island between the 1st January and the 30th April. An application for an extension of time may be granted by an Inspector of Stock, if through shortage of water or other sufficient cause it has not been possible to dip in the prescribed time.

Although the provisions of the Stock Act are complied with if the sheep are dipped once during the above period, there is no reason why they should not be put through more often. In fact, if the flock is badly infested with keds or lice it is essential that they be dipped at least twice. Poisonous dips should be used, as these are the only ones that can be relied upon to kill the vermin—especially lice. It is not difficult to kill the adult keds and lice with poisonous dips, but the eggs of the keds and the nits of the lice are much more resistant to the effect of dips, and therefore another dipping carried out about three weeks after the first one is of value for the destruction of the keds and lice hatched out subsequently to the first dipping.

One of the main reasons for failure to rid sheep of parasites by dipping is that the job is carried out with far too much hurry, and therefore the animals are not thoroughly immersed in the dip. If good results are to be obtained it is necessary for the sheep to be wet right to the skin where the parasites are found. Simply wetting the fleece is absolutely useless. When sheep are being put through a long-swim dip no trouble should be experienced in ensuring that the fleece is thoroughly saturated provided that the crutch is used and the heads plunged under once or twice to make sure the head is well wetted. It is where a short dip is used that most of the failures take place. If the fleece is to be thoroughly saturated the sheep should be in the dipping-fluid about a minute, but when a short dip is used they are often through in about a third of this time and before the fluid properly reaches the skin. Long-swim dips are the best for dipping purposes but are costly to make and fill, and for this reason are probably justified only where large flocks are being handled. Dipping can, however, be carried out just as thoroughly in a short dip provided the job is not hurried and the animals checked on their way through and given sufficient time in the fluid for the fleece to become well saturated.

Another and quite common reason for failure to get results at dipping time is that insufficient care is taken in making up the dipping fluid and the maker's instructions are not carried out properly. If good results are to be obtained it is absolutely essential that the dipping fluid be made up as laid down by the makers. Haphazard methods lead to failure to get results and disappointment to the owners of the flock.

To get results the correct amount of concentrated dip, whether powder or fluid, should be mixed with the right amount of water. To do this it is necessary to know the amount of water the dip will hold and also have the dip graduated so that water to replace that taken out by the sheep can be measured easily and accurately. When the required water has been added to the dipping-bath, the quantity of concentrate necessary can be added to bring the dipping-fluid up to the required strength.

The method often employed when measuring the capacity of the dip is to put in, say, 100 gallons of water at a time and to mark off on the side of the dip or on a rod standing upright in the dip the height to which each 100 gallons reaches. If a graduated rod is used to ascertain the quantity of fluid in a dip the rod should be shod with metal to prevent wearing away—it is necessary to use some force to make sure the rod has gone through the sediment that collects at the bottom of the dip and this tends to shorten the rod, unless properly shod.

There should be no guesswork in measuring the dipping concentrate. If a fluid concentrate is being used and a gallon is required, it should be measured carefully; likewise 2 gallons. It takes very little extra time to do this, and the results fully compensate for this little extra time and trouble. The same care when measuring is necessary if a powdered concentrate is being used. It takes a little more time and trouble to properly prepare the dipping-fluid when a powder dip is being used than it does with a fluid dip. In the first place, it is necessary to make quite sure that the powder is thoroughly broken up

and does not contain lumps, for if these are left they simply fall to the bottom of the dip and are therefore of no value in bringing the fluid up to the proper strength. The powder should be broken up as finely as possible and then mixed with sufficient water to bring it to the consistency of thick soup. This is then added to the water and the dip is thoroughly mixed, making quite sure the plunger goes right to the bottom of the dip. If the mixing has not been thoroughly carried out, there is always the possibility that the fluid at the top is over strength when first made up, with the result that the first lot of sheep put through get badly scalded and losses occur. Later on, if the fluid is left to stand and not kept mixed, the powder gradually falls to the bottom and the fluid at the top is below strength, and consequently does not destroy the parasites. From this it will be realized how very important it is to mix the dip properly in the first place and keep it mixed during dipping operations. Many appear to be of the opinion that as long as the powder has been thoroughly mixed with the water at the commencement of dipping operations, it is not necessary to use the plunger again during the day, as the very fact that the sheep are going through keeps the ingredients well mixed. Such, however, is not the case, as there is always the tendency for the powder to fall to the bottom of the dip, and to avoid this the plunger should be used not only at the commencement of dipping operations each day, but also after intervals and after every few hundred sheep have gone through. The powder is in a state of suspension rather than in solution, and the amount that will gravitate to the bottom of the dip even while the sheep are going through is surprising.

The character of the water used in making up the dipping fluid is of great importance. Hard waters do not give good results. If at all possible rain water should be used, but where sufficient is not readily at hand and spring or other hard water has to be used it should be softened by the addition of 3 lb. or 4 lb. of washing-soda, or more according to the hardness of the water, to every 100 gallons. Hard water does not "take up" the dipping concentrate well, therefore more is precipitated to the bottom and fluid at the top through which the sheep are passing is weak and unsatisfactory for killing vermin.

Sheep should be rested thoroughly immediately before being dipped. It is a mistake to dip them when overheated, as in this condition the pores of the skin are open and they are more liable to chills followed by pleurisy or pneumonia. Care should also be taken to see that the sheep are as free as possible from injuries such as dog-bites and bruising, for poisonous dips are more likely to be absorbed through a broken skin than through a sound skin. Any sheep that require dagging should be attended to in order to keep the dipping-fluid as clean as possible. Sheep should not be rushed away to the paddock as soon as they have been dipped; they should be allowed to rest and recover from the shock of sudden immersion in the dipping-fluid.

Extra care is necessary when dipping rams. They should not be dipped during the mating season, as they are then in high condition and therefore more susceptible to injuries and chills. Keenness for service is often affected, with the result that the lambing percentage suffers.

BANKS PENINSULA PASTURES AND TOP-DRESSING.

R. McGILLIVRAY, Fields Superintendent, Christchurch.

THE locality known as Banks Peninsula consists of an area of about 200,000 acres of volcanic hills overlaid on the western slopes by wind-borne soil. In the western portion of the district the tussock covering is still prominent in most places. On most other parts of the Peninsula there has been a striking establishment of cocksfoot, and in many parts it has developed so strongly as to give little opportunity for the growth of other pasture species. In a few places, however, tall fescue (*Festuca elatior*) and tall oat grass (*Avena elatior*) have found an opening, and on some of the sunny slopes of the more exposed hills danthonia is a strong invader, and *Poa pratensis* is also met with in places suitable for its growth.

Owing to the steepness of much of the Peninsula country, even grazing throughout the year is out of the question. It is inevitable, therefore, that the pasturage on extensive areas will get beyond the animals at the time of greatest pasture-production, and much of it will become too mature for best grazing results to be obtained. Cocksfoot pastures are of great importance to Peninsula farmers. Dairy stock turned out for the winter on the rough cocksfoot areas generally come through to the spring in good condition so long as the stocking is not too heavy.

The opinion of prominent farmers is that their stock winter better in this way than when they have attempted to hand-feed them during the winter period on the hay available, but it is always advisable to have some hay on hand for early spring use.

Despite the importance of the cocksfoot pastures on the more broken types of country, one can state definitely that there are considerable areas, especially on the lower slopes, eminently suitable for the establishment of good permanent mixed pastures consisting of true perennial rye-grass, white clover, and other desirable pasture constituents. Farmers on the whole, however, are not enthusiastic about ploughing for the purpose of laying down new pastures, as their experience where this has been done has not been such as to give general encouragement to such practice. Farmers who have undertaken such sowings have often found that they have not come up to expectation, and that they have proved inferior in sward and production to their cocksfoot pastures. If, however, the land where these new pastures were laid down had been limed, and fertilizers applied, and good types of rye-grass, &c., had been sown, results would probably have been quite different, as there is no reason why satisfactory pasture-establishment, a good sward, and high production should not be obtained in a favoured district like Banks Peninsula.

Liming is important on Peninsula soils, but the cost of application to hilly country is high, and that has prevented the wide adoption of the practice. Superphosphate applied as a pasture top-dressing on unlimed land has often proved unsatisfactory, and

in places no response whatsoever has been secured from super dressings. Basic-slag applications have given good results, and where lime is not available applications of slag must receive favourable consideration in any top-dressing work. Basic slag produces a most pleasing, dense dark-green pasture, consisting at times, however, of a preponderance of clovers. This latter feature has not, however, been very noticeable on the Peninsula pastures on which it has been used, but it was apparent on some of the departmental experiments. Superphosphate on limed land has proved satisfactory, and when the position is considered carefully, one would be safe to say that superphosphate plus lime applications will give as good results as basic slag, and produce slightly more growth, especially of cocksfoot. The lime applications, however, are vital if the best results are to be attained with superphosphate.

Observational top-dressing experiments were laid down on a number of farms on the Peninsula in 1927, and in the *N.Z. Journal of Agriculture*, Vol. XLI, page 388, will be found an article by Messrs. Hudson and Montgomery on the results of the experiments conducted by the Fields Division on Banks Peninsula, from 1927 to 1930. Readers are referred to this article for the earlier results of these experiments.

The statement made in this article—namely, that few farmers use fertilizers—still holds good, but the number making use of fertilizers has increased considerably, and of quite recent times decidedly more interest has been shown in the question of suitable fertilizers for pasture top-dressing purposes.

The seed-certification scheme of the Department of Agriculture and the activities of the Akaroa Cocksfoot Seedgrowers' Association have caused an impetus in cocksfoot-seed growing, and if the demand for seed is maintained the question of top-dressing the seed areas even on relatively steep country must receive serious consideration, as intensive seed-production cannot be maintained indefinitely without the use of suitable fertilizers.

The Peninsula soils have been highly productive, but deterioration of pastures has been evident for many years past. This, in the natural course of events, was to be expected in country settled as early as were parts of the district under review, especially when top-dressing was not considered until recent times, and where even yet it is only in its infancy.

The first departmental trials were laid down in 1927 on ten farms, and several of these trials were kept going until 1933, some not being finalized until 1934. For the layout of these experiments readers are referred to Vol. XLI of the *N.Z. Journal of Agriculture*, page 389. The report by Messrs. Hudson and Montgomery contains information as to results up till 1930, but further information largely of a confirmative nature was obtained from observations taken on some of the experiments up till the abandonment of the trials in 1934, and it is proposed to comment briefly on the four experiments that have been under observation until recently.

J. G. Waller, Okuti Valley.—Lime response very noticeable, and of the fertilizers basic slag gave the best results, but during late autumn and early spring ephos phosphate gave a sward almost equal to basic slag. The other fertilizers were largely ineffective.

Kay Bros., Duvauchelle.—A particularly good response to lime and applications of phosphates was noted. The limed portions were more closely grazed than the unlimed. Superphosphate gave excellent results on limed land. Basic-slag results were good, especially on the limed land, but production was hardly as high as on the superphosphate-lime plots, where there was a particularly well-balanced pasture.

T. Wakelin, Duvauchelle.—A distinct lime response was noticeable, and on the limed land both superphosphate and basic slag gave results that could be considered as payable. The superphosphate plots did not show the same amount of clover as the slag plots.

A. Orme, Robinson's Bay.—A good lime response, and all phosphates on limed land gave responses of varying degree. Potash showed a definite response when used with lime and superphosphate. The response was shown in the clover growth, which was very vigorous, and the grazing was very close. Of the phosphates, superphosphate and basic slag can be considered as equal in response on the limed land, but slag was better than superphosphate on the unlimed land.

During visits to the various experiments it was possible to take observations at all seasons of the year and to observe the grazing preferences shown by stock, and the effect of such grazing on the pastures. In all cases close grazing induced a close and leafy sward that invariably appeared to be extremely palatable. In these trials, and especially in the later stages, basic-slag dressings produced the type of pasture mentioned, but superphosphate on limed land was a good second, and in all cases there was to some extent greater production from the superphosphate-lime combination.

Present indications are that the day of almost general top-dressing on the Peninsula is at hand. The importance of the enrichment of the soil with fertilizers is now becoming fully appreciated, and there is some indication that farmers are realizing the necessity of top-dressing their pastures for general farming purposes and also for seed-production.

GOVERNMENT OFFICIAL HERD-TESTING OF PUREBRED DAIRY COWS.

SUMMARY OF THE 1933-34 SEASON'S WORK.

W. M. SINGLETON, Director of the Dairy Division, Wellington

THE Government Official Herd Test has now completed seven years' operation, and during that period some 12,733 statements of yield have been issued to breeders for cows tested under this system. The Official Herd Test summary is based on the year ending 30th September, some 2,185 cows having been tested during the period under review—an increase of 493 over the preceding year's total of 1,692 cows. There was also a marked increase in the number of herds, the figure for 1933-34 being 184, as compared with 163 for 1932-33. It is also pleasing to be able to record an increase of 2·12 lb. butterfat

in average production, last year's average having reached the creditable level of 311·90 lb., as against 309·78 for the previous year. It will be noted from Table 1 that the average milking period declined by three days, being 280 for the past year, as compared with 283 for 1932–33.

From the point of view of the breeds, the special feature is the marked increase in the number of Friesians placed under test. The Jerseys have also increased considerably, and in view of the large number of cows tested the average production for the breed of 324·72 lb. fat must be regarded as very satisfactory.

The production figures already quoted, together with those in the accompanying tables, are on the basis of all cows in milk 180 days or more, this being regarded as the most satisfactory classification for purposes of this summary.

In addition to registered purebreds, a certain number of grade cows are tested each year, these being odd cows in the herds of testing breeders. Last year the number of such cows was thirty-two, as compared with forty-nine the preceding year. The records of these cows are not taken into consideration in the tables. The number of registered purebred animals which did not remain on test 180 days was 158.

The following statistics will enable an interesting comparison to be made between Government Official Herd Test results and those for other systems in operation in the Dominion: New Zealand's average herd-tested cow for 1933–34, including all cows in milk 100 days or more, yielded 262·44 lb. butterfat in 255 days. The Official Herd Test average on the same basis works out at 306·13 lb. fat in 276 days. The Certificate-of-Record 305-day test average was 447·35 lb., and the Certificate-of-Record 365-day test, 523·10 lb.

Table 1—Official Herd-testing in Two Past Seasons on Basis of all Cows on Test for 180 Days or more

Breed.	Number of Breeders.	Number of Cows.	Average Yield for Season.		
			Days.	Milk.	Butterfat.
Season 1932–33.					
Jersey	132	1,087	284	5,988·6	320·44
Friesian	20	253	280	8,506·0	301·91
Ayrshire	2	31	284	5,957·4	233·28
Milking Shorthorn ..	7	125	275	6,623·8	265·39
Red Poll	2	29	297	6,209·8	251·81
Totals	163	1,525	283	6,461·9	309·78
Season 1933–34.					
Jersey	152	1,393	282	5,998·0	324·72
Friesian	18	399	281	8,070·6	283·53
Milking Shorthorn ..	7	142	275	7,341·4	294·93
Ayrshire	2	25	253	6,430·3	265·14
Red Poll	2	25	251	5,227·9	209·19
Guernsey	1	5	275	6,113·9	310·25
Shorthorn	1	6	301	6,367·4	248·17
Totals and averages	179*	1,995	280	6,505·3	311·90

* Totals do not agree for the reason that some breeders tested more than one breed.

Table 2.—Average Production in Classes and Breeds for all O.H.T. Cows.

Class.		Season 1932–33.				Season 1933–34.			
		Number of Cows.	Average Days.	Average Milk.	Average Butterfat.	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.
				lb.	lb.			lb.	lb.
Jersey	Two-year-old and under	462	283	5,365·9	290·57	561	283	5,383·4	292·85
	Three-year-old	179	282	5,925·7	318·47	258	286	6,196·0	339·64
	Four-year-old	161	286	6,479·8	345·72	210	279	6,358·0	344·65
	Mature	285	285	6,760·1	355·81	364	280	6,597·1	351·77
Friesian	Two-year-old and under	56	281	7,139·7	252·96	155	282	6,619·6	230·47
	Three-year-old	49	281	8,400·1	297·54	55	279	7,975·8	285·48
	Four-year-old	47	281	9,293·2	330·18	75	281	9,009·0	314·24
	Mature	101	278	8,948·6	318·03	114	282	9,471·6	334·54
Milking Shorthorn	Two-year-old and under	34	270	5,005·5	205·72	40	272	6,183·5	251·12
	Three-year-old	21	275	6,431·8	262·16	22	273	6,736·3	275·68
	Four-year-old	21	281	7,194·5	291·27	24	268	7,054·1	285·24
	Mature	49	276	7,584·3	297·09	56	281	8,529·3	337·92
Ayrshire	Two-year-old and under	18	285	5,439·7	214·54	16	253	6,088·7	252·31
	Three-year-old	6	288	6,434·0	257·00	6	240	6,595·7	263·50
	Four-year-old	2	305	6,504·3	239·15	1	222	6,310·2	279·15
	Mature	5	268	7,030·6	269·93	2	305	8,727·0	365·63
Red Poll	Two-year-old and under	9	305	5,151·9	210·28	14	239	4,535·2	180·54
	Three-year-old	5	305	5,589·3	223·40	5	274	5,830·8	235·60
	Four-year-old	7	299	7,063·8	293·76	4	253	5,626·7	220·09
	Mature	8	284	7,040·6	279·59	2	280	7,772·4	321·86
Guernsey	Two-year-old and under	Not represented				..	..	..	..
	Three-year-old					1	216	4,141·9	216·00
	Four-year-old					2	305	6,366·2	327·21
	Mature					2	276	6,847·6	340·43
Shorthorn	Two-year-old and under	Not represented				3	298	5,429·6	209·32
	Three-year-old					1	305	6,010·2	264·95
	Four-year-old					..	..	..	..
	Mature					2	305	7,952·8	298·07

THE OFFICIAL SEED-TESTING STATION.

RECORD OF TESTING OPERATIONS FOR YEAR 1933.

NELSON R. FOY, Seed Analyst, Plant Research Station, Palmerston North.

FOR the calendar year 1933 17,122 seed-samples were tested at the Department's Seed-testing Station at Palmerston North. This total represents an increase of 3,205 on the number tested during the previous year, the increase being due largely to the very considerable number of trade samples of rye-grass submitted during September, October, and November.

Tables 1, 2, and 3 show the distribution, origin, classification, &c., of the various commercial samples received.

With the exception of the rye-grasses, root, forage, and vegetable seeds, all tests were made according to the rules prescribed by the International Seed-Testing Association. For those seeds excepted above, samples were, on request, tested for germination only: of these most of the rye-grass samples represented farmers' dressed, and these were "dressed" prior to testing and reported as being "germinated on a machine-dressed basis."

PURITY.

In none of the grasses and clovers were there marked deviations in average purity from general standards. The percentage of samples in which seeds of noxious weeds occurred and the rate of occurrence are shown in Table 9. The percentage of samples in which ergot was recorded is presented in the same table.

GERMINATION CAPACITY.

Generally, germination capacity was up to standard. The average figures for perennial rye-grass were not markedly different from those for the previous year. Hawke's Bay, Poverty Bay, North and Mid Canterbury, and Central Otago still stand as the most favourable production districts for rye-grass so far as germination is concerned. Manawatu was slightly above average for that district, while the averages for the southern districts were consistently low.

ULTRA-VIOLET-LIGHT EXAMINATION OF RYE-GRASS SEEDLINGS.

For New Zealand seed the ultra-voilet-light method of examination continues to give satisfactory results in the identification of lines of relatively superior type, and is employed as a check test on samples of all lines of certified perennial rye-grass and for the classification as "perennial" of commercial samples submitted by the trade and growers.

Tabulated results of the examinations for the last-named samples are presented in Table 8. The A classes represent perennial and the B classes false-perennial types, A1 and B4 representing the two extremes in the perennial scale.

Average percentages of purity and germination capacity for all grass and clover species are presented in Tables 4, 5, 6, and 7, which are self-explanatory.

Germination Capacity of Cereals, Vegetables, Field Roots, etc.

The average germination capacity for samples of cereals, field roots, vegetables, and flower-seeds are as follow :—

Cereals, &c.

	Per Cent.		Per Cent.		Per Cent.
Oats	75	Rye-corn	74	Blue lupin	89
Wheat	94	Maize	91	Flax (*Linum*)	85
Barley	90	Japanese Millet	92		

Vegetables.

Asparagus	94	Corn	95	Parsley	57
Beet	94	Cress	97	Parsnip	43
Beans	95	Cucumber	87	Pumpkin	86
Broccoli	86	Lettuce	93	Radish	84
Cabbage	78	Leek	72	Rhubarb	72
Cauliflower	76	Marrow	89	Spinach	45
Carrot	65	Melon	83	Squash	91
Celery	83	Onion	77	Tomato	89

Roots and Forages.

Swede	90	Kale	87	Mangel	85
Turnip	92	Carrot	65	Mustard	95
Rape	89				

Flowers.

Aster	60	Marigold	52	Stock	56
Anemone	38	Phlox	57	Ranunculus	3
Cosmos	50	Salvia	57	Verbena	35
Delphinium	82	Sweet peas	80		

Forest Trees

Cupressus macrocarpa	9	Eucalyptus	88	*Pinus radiata*	67
Douglas fir	63				

The assistance of Mr. J. Watt in the compilation of the tabulations used in this report is cordially acknowledged.

Table 1.—Origin and Classification of Total Samples, 1933 and 1932.

Origin.	Purity only.		Purity and Germination		Germination only.		Ultra-violet Light.		Total.
	1933.	1932.	1933.	1932.	1933.	1932.	1933.	1932.	1933.
Seed-merchants	**224**	84	**8,058**	5,152	**4,190**	3,660	**328**	215	**12,800**
Seed-growers and farmers	**3**	1	**167**	159	**61**	76	**33**	16	**264**
Department of Agriculture—									
Fields Division—									
General	**12**	2	**128**	93	**67**	130	**50**	36	**252**
Stores purchasing	**1**	..	**362**	461	**107**	133	..	..	**470**
Plant Research Station	..	5	**41**	47	**354**	645	**1,399**	1,130	**1,794**
Seed-testing Station	**2**	189	**120**	18	**1,338**	991	..	498	**1,460**
Other Government Departments	..	1	**68**	29	..	3	**14**	..	**82**
Totals	**242**	282	**8,939**	5,959	**6,117**	5,638	**1,824**	1,895	**17,122**

Note re *Table 1.*—Opposite "Seed-testing Station," the 1,460 samples tested consisted of 990 tests in connection with the investigational work on hand, 332 samples check tests (technique), and 146 sample retests.

Table 2.—Number of Commercial Samples from Land Districts and Centres therein, 1933 and 1932.

South Island.	1933.	1932.	North Island.	1933.	1932.
Southland (total) ..	2,887	2,370	Wellington (total) ..	3,827	2,193
Gore	1,608	1,466	City	1,502	809
Invercargill ..	1,219	874	Palmerston North and Feilding	1,420	1,033
Other	60	30	Other	405	351
Otago (total) ..	1,225	849	Hawke's Bay ..	903	645
Dunedin	1,010	719	Gisborne	360	229
Other	215	130	Taranaki	320	438
Canterbury (total) ..	2,515	1,409	Auckland (total) ..	1,016	716
Christchurch ..	1,440	843	City	968	651
Other	1,075	566	Other	48	65
Marlborough ..	179	200	North Auckland ..	56	49
Nelson	12	13			
Total, South Island	6,818	4,841	Total, North Island	5,982	4,270

Table 3.—Number of Commercial Samples tested of the various Species of Grasses and Clovers, 1933 and 1932.

Species.	Number. 1933.	Number. 1932.	Species.	Number. 1933.	Number. 1932.
Grasses—			Clovers—		
Perennial rye-grass ..	4,005	2,281	White clover ..	778	400
Italian rye-grass ..	571	210	Red clover ..	512	307
Western Wolths rye-grass	200	113	Alsike	71	61
Cocksfoot ..	443	370	Alsike and white clover	17	17
Crested dogstail ..	907	543	Subterranean clover	40	17
Chewings fescue ..	985	951	Strawberry clover ..	6	9
Brown-top ..	380	375	Crimson clover ..	20	11
Danthonia spp. ..	45	41	Suckling clover ..	84	30
Timothy	84	72	Lucerne	110	121
Fog	70	53	Trefoil	28	20
Meadow fescue ..	17	20	Lotus major ..	82	48
Meadow foxtail ..	33	25	Lotus hispidus ..	10	1
Paspalum ..	70	94	Other clovers, &c. ..	30	7
Poa pratensis ..	34	32			
Poa trivialis ..	12	7		1,788	1,049
Prairie grass ..	31	20			
Red-top	3	2			
Miscellaneous grasses ..	25	18	Cereals, vegetables, &c.—		
			Oats	117	109
	7,915	5,227	Wheat	71	65
			Barley	81	60
Roots and other forages—			Rye-corn	2	3
			Vetches	1	7
Swede	247	207	Peas (garden and field)	265	308
Turnip	369	326	Japanese millet ..	15	11
Rape	148	90	Vegetables ..	462	561
Kale	105	99	Flower-seeds ..	41	18
Mustard	23	24	Forest-tree seeds ..	7	8
Mangel	186	206	Seed mixtures ..	10	32
Carrot (field and garden)	104	137	Miscellaneous ..	36	7
	1,182	1,079		1,108	1,189

Table 4.—Average Percentages of Purity and Germination Capacity for Certified Grass-seed, 1933 (officially drawn Samples).

—	Purity. Average Percentage. Pure Seed.	Other Crop Seed.	Weed-seed.	Inert Matter.	Germination Capacity. Average Percentage.	Percentage of Samples germinating, in Groups. Below 80	80–90.	90–100.	Average Percentage of Pure Germinating Seed.	Number of Samples.
Certified perennial rye-grass—										
All samples ..	**98·8**	0·2	0·6	0·4	**92**	10	10	80	**91**	1,315
Southland-grown	**99·1**	0·1	0·5	0·3	**56**	86	14	..	**55**	28
Otago ..	**97·9**	0·4	0·8	0·9	**84**	24	34	42	**82**	12
Central Otago ..	**98·9**	0·1	0·6	0·4	**97**	..	7	93	**96**	27
North Otago ..	**99·3**	0·1	0·3	0·3	**76**	49	21	30	**75**	24
South Canterbury	**99·4**	0·1	0·3	0·2	**81**	36	32	32	**80**	75
Mid-Canterbury	**98·7**	0·1	0·4	0·8	**92**	8	6	86	**91**	35
North Canterbury	**99·2**	0·1	0·4	0·3	**91**	9	18	73	**92**	128
Nelson and Marlborough	**97·7**	0·2	0·7	1·4	**93**	7	13	80	**91**	15
Wairarapa ..	**98·4**	0·5	0·7	0·4	**92**	7	21	72	**90**	28
Manawatu ..	**99·0**	0·2	0·6	0·2	**81**	34	34	32	**80**	102
Wanganui ..	**97·0**	1·0	0·8	1·2	**78**	44	37	19	**76**	16
Hawke's Bay ..	**98·8**	0·2	0·7	0·3	**97**	..	2	98	**96**	558
Poverty Bay ..	**98·4**	0·4	0·8	0·4	**96**	3	4	93	**94**	269
Auckland ..	**99·0**	Nil	0·1	0·9	**86**	..	100	..	**85**	1
Certified brown-top	**98·9**	Trace	0·1	1·0	**91**	4	14	82	**90**	98
Certified cocksfoot—										
All samples ..	**82·6**	2·3	0·3	14·8	**89**	8	30	62	**74**	50
Akaroa-grown..	**80·6**	2·7	0·4	16·3	**88**	12	27	61	**71**	33
Canterbury-grown	**86·4**	1·5	0·2	11·9	**92**	..	35	65	**79**	17

Table 5.—Average Percentages of Purity and Germination Capacity for Grass-seed other than Certified Seed.

—	Purity. Average Percentage. Pure Seed.	Other Crop Seed.	Weed-seed.	Inert Matter.	Germination Capacity. Average Percentage.	Percentage of Samples germinating, in Groups. Below 80	80–90	90–100	Average Percentage of Pure Germinating Seed.	Number of Samples.
Cocksfoot ..	**79·2**	3·1	0·8	16·9	**85**	20	34	46	**68**	443
Brown-top ..	**96·7**	Trace	0·2	3·1	**90**	12	23	65	**87**	380
Perennial rye-grass	**98·2**	0·6	0·7	0·5	**90**	15	15	70	**88**	2,394
Italian rye-grass ..	**99·2**	0·1	0·4	0·3	**93**	4	16	80	**92**	368
Western Wolths rye-grass	**99·2**	0·1	0·4	0·3	**89**	9	16	75	**88**	57
Crested dogstail ..	**98·2**	1·1	0·4	0·3	**82**	32	16	52	**80**	907
Chewings fescue ..	**98·2**	0·6	0·3	0·9	**89**	16	8	76	**87**	985
Danthonia spp. ..	**62·5**	3·2	16·7	17·6	**61**	80	20	..	**38**	45
Meadow fescue ..	**98·8**	0·1	0·3	0·8	**79**	24	18	58	**78**	17
Meadow foxtail ..	**59·0**	1·8	1·8	37·4	**68**	61	33	6	**40**	33
Paspalum ..	**59·8**	Trace	0·2	40·0	**75**	36	53	11	**51**	70
Poa pratensis ..	**83·5**	Trace	0·2	16·3	**86**	15	32	53	**71**	34
Prairie grass ..	**95·8**	0·3	0·3	6·7	**70**	54	23	23	**67**	31
Timothy ..	**99·5**	0·2	0·1	0·2	**94**	1	5	94	**93**	84
Yarrow ..	**90·8**	1·7	2·4	5·6	**79**	23	33	44	**72**	21
Yorkshire fog ..	**88·5**	8·2	1·9	1·4	**89**	5	39	56	**76**	70

Table 6.—Average Germination Percentages for Commercial Samples of Rye-grass tested for Germination only, 1933.

—	Average Percentage of Germination.	Percentage of Samples germinating, in Groups.			Number of Samples.
		Below 80.	80–90.	90–100.	
Permanent rye-grass—					
All samples ..	**82**	27	27	46	1,611
Southern-grown ..	**80**	30	32	38	851
Canterbury-grown ..	**86**	23	20	57	323
Manawatu-grown ..	**75**	42	33	25	185
Hawke's-Bay-grown	**94**	7	5	88	116
Poverty-Bay-grown	**88**	18	4	78	54
Italian rye-grass ..	**92**	5	20	75	203
Western Wolths rye-grass	**90**	11	23	66	143

Table 7.—Average Percentages of Purity and Germination Capacity of Samples of Clover and Related Species, 1933.

—	Purity Percentages.				Germination Capacity.				Percentage of Hard Seed.	Average Percentage of Pure Germinating Seed.	Number of Samples.
	Pure Seed.	Other Crop Seed.	Weed-seed.	Inert Matter.	Average Percentage.	Percentage of Samples germinating, in Groups.					
						Below 80.	80–90.	90–100.			
White clover—											
All samples ..	**88·7**	8·8	1·8	0·7	**84**	28	25	47	12	**79**	778
All certified ..	**89·5**	8·3	0·8	1·4	**89**	21	17	62	8	**80**	63
Hawke's Bay grown	**87·5**	9·9	1·2	1·4	**92**	6	15	79	4	**82**	47
Canterbury-grown	**92·9**	4·8	0·4	1·9	**78**	54	37	9	18	**79**	11
Other districts ..	**77·4**	1·9	0·4	0·3	**79**	80	..	20	15	**81**	5
Red clover—											
All samples ..	**98·9**	0·2	0·3	0·6	**89**	8	29	63	7	**92**	512
Certified ..	**99·4**	0·6	0·4	1·6	**82**	33	67	..	15	**85**	44
Alsike	**97·3**	1·9	0·4	0·4	**76**	34	28	38	4	**75**	71
Subterranean clover	**98·6**	0·4	0·3	0·7	**75**	68	30	2	18	**80**	40
Strawberry clover	**98·0**	Trace	0·2	1·8	**89**	16	84	..	2	**88**	6
Crimson clover ..	**98·1**	0·2	0·3	1·4	**72**	45	10	45	Nil	**72**	20
Suckling clover ..	**83·0**	13·2	3·3	0·5	**57**	86	8	6	32	**56**	84
Lucerne ..	**98·5**	0·7	0·2	0·6	**77**	44	30	26	18	**85**	110
Trefoil	**99·1**	0·2	0·2	0·5	**68**	60	29	11	3	**65**	28
Lotus major ..	**92·5**	6·0	1·0	0·5	**74**	51	39	10	10	**71**	82

Table 8.—Number and Classification of Samples of Rye-grass examined under Ultra-violet Light.

Classification.	Seed Trade.		Farmers.		Total.	
	Number of Samples.	Percentage of Samples.	Number of Samples.	Percentage of Samples.	Number of Samples.	Percentage of Samples.
A1 ..	103	31	3	9	106	30
A2 ..	126	38	10	31	136	39
A3 ..	41	12	5	15	46	12
B1 ..	25	8	6	18	31	8
B2 ..	12	4	3	9	15	4
B3 ..	9	3	5	15	14	4
B4 ..	12	4	1	3	13	3
Total..	328	..	33	..	361	..

Table 9.—Percentage of Samples containing Approximate Rate of Occurrence of Seeds of Noxious Weeds and of Ergot.

Seed.	Percentage of Samples.	Seeds per Ounce.	Seed.	Percentage of Samples.	Seeds per Ounce.
Cirsium arvense (Californian thistle).					
Rye-grass ..	1	1– 6	Red clover ..	1	2– 3
Chewings fescue ..	1	1– 2	Alsike	6	1– 3
Crested dogstail ..	14	1-60	Alsike and white clover	6	1– 3
Cocksfoot ..	7	1–10			
Timothy	1	1– 3	Suckling clover ..	1	2–12
White clover ..	1	1– 2	Lotus major ..	5	2–10
Cuscuta spp. (clover dodder).					
White clover ..	1	1 40	Lotus major ..	11	3–98
Red clover ..	1	2–10	Lotus hispidus ..	20	3–20
Senecio Jacobaea (ragwort).					
Brown-top ..	4	2–160	Lotus major ..	12	2–30
Chrysanthemum leucanthemum (ox-eye daisy).					
Timothy	4	1– 3	Yorkshire fog ..	1	1– 5
Claviceps purpurea (Ergot sclerotia).					
Rye-grass ..	14	..	Yorkshire fog ..	27	..
Chewings fescue ..	4	..	White clover ..	15	..
Crested dogstail ..	20	..	Red clover ..	12	..
Cocksfoot ..	7	..	Alsike	1	..
Brown-top ..	84	..	Alsike and white clover	24	..
Danthonia ..	2	..			
Poa pratensis ..	6	..	Suckling clover ..	11	..
Prairie-grass ..	3	..	Lucerne	2	
Timothy	9	..	Lotus major ..	6	..
			Lotus hispidus ..	40	..

DOMINION POTATO CROPS.

The table below relative to the potato crops in the last two seasons has been compiled by the Census and Statistics Office :—

—	Area in Potatoes.	Yield of Potatoes.			
		Table.	Seed.	Pig.	Total.
1933–34	25,028	86,995	28,901	15,149	131,045
1932–33	24,605	77,629	33,891	17,559	129,079

The figures are in respect of all holdings of 1 acre or over situated outside borough boundaries. In the 1933–34 season 14,242 acres, of a total yield of 73,324 tons, were grown in Canterbury.

An increasing interest is being taken in grape-growing in the Dominion, both for table and wine-making purposes. New-Zealand-made wines are gradually coming more into favour, and there is an indication of the demand reaching considerable dimensions in the near future. The season's output of wine is estimated at 138,150 gallons, a substantial increase on the previous year's figures, and represents a wholesale value of £48,352.

PRACTICES IN THE USE OF BLUE LUPINS FOR FEED, SEED, AND GREEN MANURE.

Fields Division, Department of Agriculture.

An introductory article by Mr. R. McGillivray on the use of blue lupins (*Lupinus angustifolius*) in Canterbury was published in the *Journal of Agriculture* for July, 1934 (p. 41). A further article describing the experience of Mr. W. Hammond, Winchmore, and written by Mr. A. H. Flay, Lincoln College, was published in the *Journal* for November, 1934 (p. 289).

In order to procure definite information relative to practices adopted by farmers and to get their opinions on the value of lupins for the purposes for which they were used, information was collected by means of a questionnaire. Twenty-one farmers supplied information which is summarized below. Of the twenty-one farmers sixteen are in Canterbury and five in Southland. Fifteen of the sixteen Canterbury farmers have grown lupins for periods of from four to ten years and one of them for one year only. Four of the Southland growers had one year's experience only, and one had grown lupins for seven years, but for feeding purposes for only one year.

Lupins for feeding Stock.

Number of Farmers feeding Lupins.—Twenty farmers supplied information relative to the feeding of sheep and/or lambs on lupins, fifteen being in Canterbury and five in Southland. Of those supplying information none had used the crop for feeding cattle.

Class of Land.—With the exception of one Canterbury and four Southland farmers who have grown lupins on what is described as heavy land, the crop has been confined to light to medium soils, some of which are described as good wheat land.

Accompanying Crops.—In all cases where feeding has been the objective lupins have been grown in association with some other crop or crops as indicated below.

Number of Farmers.*	Accompanying Crop.
4	Grass†.
3	Rape, turnips, and grass.
1	Rape, turnips, and kale.
5	Turnips.
8	Rape.
2	Oats and grass.
2	Oats.

Width of Row and Rates of Seeding.—Sowing the lupins in 14 in. rows with rape, turnips, or kale sown from the intermediate coulters is the more common method where these crops are in association, giving rows of lupins alternating with rows of the other crop, every coulter being used to sow one or the other. In some cases, however, both lupins and the accompanying crops are being sown down every coulter, the

* Several farmers gave alternative methods, so that the total number shown above is greater than the number of farmers submitting information.

† Whether perennial or Italian rye-grass is not stated. It is known, however, that a number of farmers are sowing lupins along with perennial rye-grass pastures.

grass-seed being broadcast where it is sown as well. Rates of seeding ranged from ½ to 2 bushels per acre, 1½ bushels being a favoured rate.

Manuring.—Fourteen growers supplied information on manuring. Seven use super at 1 cwt. per acre; three use a mixture of super and lime (equal parts) at 1 cwt. to 3 cwt. per acre; and four state that the manuring is as for the accompanying crop.

Times of Sowing and Times when ready for Feeding.—The most popular times of sowing are from September to December, although a good proportion of growers sow also in January and some during February, March, and April. In respect of autumn sowing one farmer comments as follows: "Lupins sown later than March are apt to catch early frosts, and lupins in the early seedling stage are very susceptible to frost injury. When in full leaf they will withstand hard frosts."

The various months of sowing, together with the probable times when the crop will be ready for feeding green and in the pod stage (see "Stage of Feeding" below) as indicated by the information supplied, are shown in the following table:—

Month of Sowing	Ready for Feeding.	
	Green.	In Pod Stage.
September	January	February–March.
October	January	March–April.
November	February.. ..	April May
December	March-April ..	May.
January	May June ..	*
February–March–April	September†–October	December

* Very little information available

† Flay (this *Journal*, Nov., 1934, p 289) reports lupins sown in February as in the "full-leaf" stage in June and July. They commenced flowering in September.

Obviously the rapidity of growth will be influenced by soil and climate, and the above must be regarded as approximate only.

Stage of Feeding.—Eleven farmers feed in the pod stage only. Apparently the stocking of the crop commences when the lower pods are yellow and the seed firm but not hard. Four commence feeding before flowering and continue during flowering and podding stages; two feed in the green stage only; and one specifies the flowering stage as that at which the crop is fed. Obviously the feeding when pods have formed is the most common.

Class of Sheep fed.—Fourteen growers used the crop for sheep and lambs or sheep and hoggets; two used sheep only, and four. lambs only.

Fattening-qualities.—Thirteen growers expressed opinions regarding the suitability of lupins for fattening lambs. Seven were of the opinion that the crop was suitable for fattening lambs, and five stated that it was not, one indicating the fattening capabilities as "slow."

Eleven opinions on fattening of sheep resulted in eight being favourable for lupins and three unfavourable.

It must be remembered that the lupins were in association with some other crop in each instance. The data did not permit of a determination of the relationship of stage of feeding to fattening capacity. Estimates of the fattening-capacity per acre for sheep ranged from 12 to 47, and for lambs from 12 to 33.

Palatability.—Twelve farmers supplied information on this point. Eleven stated that sheep always ate the accompanying crop in preference to the lupins. One individual's experience was that no preference was shown for either lupins or other crop, and two of the eleven pointed out that sheep used to lupins eat them as readily as they do the accompanying crop, especially in late stage of maturity.

Lupins for "Hay."—Two growers have cut and stacked the crop for winter feed. One states that the crop is cut when ripe, while the other sows with oats and cuts when either the oats or lupins are ripe, depending on which is ripe first.

Trouble with Stock.—Eleven experienced no trouble with stock when fed on lupins. Nine had trouble, and in some cases loss of stock attributed to the lupins. The trouble experienced was most commonly described as "staggers," although one farmer described the symptoms as those of "bloat" and one encountered "scalded feet." The trouble experienced occurred at various stages of maturity of the crop and commenced after the sheep had been on for a few days in some cases, and for several weeks in others. Some farmers whose sheep developed staggers stated that they recovered after they had been removed to a grass paddock for a day or two. Another who has had no trouble considers it necessary to allow sheep free range of an adjoining grass paddock when being fed on lupins.

Growers' Opinions.—The following data indicate the summarized opinions of growers regarding lupins for sheep-feed: 7 farmers, excellent; 5, good; 1, satisfactory; 3, poor*; 4, non-committal.

LUPINS FOR SEED-PRODUCTION.

Sixteen growers of seed supplied information regarding their practices, which in brief are as follow:—

Width of Row and Rate of Seeding.—Practically all sow in 7 in. rows. The rate of seeding ranged from ¾ to 2 bushels per acre, the latter quantity being by far the most common.

Time of Sowing and Harvesting.—Some growers sow in both spring and autumn, the former being the more popular. Eleven recorded sowing in September or October, and harvesting from February to May, but mostly in March and April. Eight, some of whom also sow in the spring, sow from February to April and harvest in December or January.

The crop is viewed as a difficult one to harvest, especially in hot weather, when much seed is lost. Seed shed at harvest is sometimes disked in for a catch crop for feeding in the winter.

Harvesting Methods.—Stacking prior to threshing and after cutting with a side-delivery or reaper and binder was adopted about as frequently as using the header-harvester with a pick-up attachment after windrowing. Two growers used the header-harvester in the standing crop.

Yields.—Estimated yields ranged from 10 to 50 bushels per acre, some individual growers indicating the above range in their own crops. Several emphasized the difficulty of harvesting without appreciable loss of seed.

* All of these were Southland farmers on heavy land. See also "Remarks of Growers."

Lupins for Green Manure.

Eleven growers supplied information relative to practices adopted in growing the crop for green manure.

Method of Sowing and Rate of Seeding were practically the same as for seed-production.

Time of Sowing and Ploughing-in.—With a few exceptions, sowing was done from January to April and the crops ploughed in between May and October. The few exceptions were crops sown from September to November and ploughed in from December to February.

Favourable Remarks by Growers.

C. C. Winn, Lyndhurst—They are an excellent sheep-feed Have a marked effect on wool, and ewes lambing off lupins are dropping splendid lambs. Ewes in great buckle. Fully convinced that on medium land such as mine lupin-growing has become a necessity, and the rapid rise in soil-fertility is more than evident.

H. Reesby, Lyndhurst.—Would not be without them. Sheep came through with wonderful bloom.

L. C. Anderson, Lyndhurst.—Never had more safe feed—no losses. First-class sheep-feed, and greatly assists in keeping land in good heart.

W. R. Hammond, Winchmore.—Lupins with 1 bushel of Western Wolths or Italian rye-grass as a winter feed are most decidedly preferable to turnips on this class of country (light to medium stony plains land). Consider that lupins will replace turnips for winter feed on the drier and lighter country. Have had trouble with stock only with lupins in early seedling stage when effect similar to ergot. Had no deaths.

C. G. Jarman, Darfield.—A great soil-improver. Very valuable as a standby in dry autumns and especially valuable for fattening old ewes. I would not advise sowing by themselves as a fodder, as they take a long time to mature, but my experience is that they will grow with rape, kale, and turnips without affecting the growth of such to any great extent.

(Note.—This farmer had serious loss of lambs once only in seven years' growing of lupins.)

H. Wright Johnson, Dunsandel.—I have been growing lupins for ten years for seed, green manure, and sheep-feed mixed with oats and rape. Apart from any value they may have for feeding purposes, I have found them an excellent green manure crop.

M. S. Bower, Swannanoa.—A very valuable plant about which much is yet to be learnt. Very good for green manuring, but its sheep-feeding qualities are yet to be definitely proved according to my experience. Sheep gorging on the seed will die and when forced on to green lupins without other feed. (Note.—This farmer has been growing lupins for six years and reports fifteen to twenty deaths. Presumably these occurred in one year, but point is not clear.)

J. S. Thomson, Kirwee.—Have found them a satisfactory supplementary feed for ewes in autumn when other feed in short supply.

H. M. Marshall, Weedons.—Consider them a valuable winter feed for ewes when sown with turnips. Have had no outstanding results from lupins as a green manure.

W. H. Marshall, Prebbleton.—Consider them an excellent green manure crop. Can grow two consecutive crops of wheat on land where I could grow only one crop previously.

H. Oliver, Hororata.—I intend to try them again. I found that, mixed with rape, lambs did well on them and did not scour. I find wethers on turnips sown along with ½ bushel lupins per acre are doing well and are eating the lupins right down. (This farmer has grown lupins for one season only.)

F. E. Morrish, Springston.—I consider lupins an excellent catch crop for sheep-feed, and would not be without them. Slight staggering in ewes, but no deaths attributable to grazing lupins. I consider wheat does better after rape fed off or peas harvested than after lupins harvested.

H. E. Cross, Sandy Knolls.—So far I have used them principally for green manure, but I am of the opinion that they are a good standby for sheep-feed under dry conditions.

A. E. Cross, Bennetts.—My opinion of lupins is that they are a good soil-builder and a good standby in case of a failure of turnips or rape crops, and now I would not like to be without them.

H. M. McAdam, Invercargill-Glencoe R D.—So far as my experience goes (one year) I find them first-class feed, and though I had a poor crop and put on too many lambs they improved on them, did not scour, and I had no trouble starting them. (NOTE.—This farmer is on lighter soil than other Southland farmers quoted.)

R. Martin, Otama.—For green-manuring they are very good, but I would not be prepared to give any definite opinion as regards fattening or grazing, as I have only had one season's experience. (NOTE.—This farmer has been growing lupins for seven years. Last season he drafted his lambs and put one hundred on 3 acres lupins and oats for four weeks, after which most of them were prime).

One other farmer whose remarks were favourable failed to reply to a request to publish his remarks. Consequently, they are not included.

UNFAVOURABLE REMARKS BY GROWERS.

D. Marshall, Springston.—Have used mainly for ploughing in prior to grassing down. Recent seasons have been so dry and lupin growth so light that no marked improvement in growth of grass was obtained as a result of ploughing in lupins. Have had as good results with grass following oats fed off.

J. Cochrane, Invercargill-Otahuti R.D.—They do not suit our climatic conditions and do not ripen quickly enough to be of much or any value as a good lamb-feed. Also they are not palatable to stock in the early stages of growth, thus losing what should be the most suitable fattening-feed—*i.e.*, the green leaves. (NOTE.—This farmer tried fattening lambs, but states that he " took them off before they went back.")

A. Moore, Waimatuku.—Not suitable for lamb-fattening in Southland. Problematical whether crop could be harvested successfully in this district, due to its long growing season and high rainfall experienced.

A. H. Hall, Thornbury.—Not suitable for lamb-fattening in Southland. Lambs were not closed on area and lupins were barely touched. (NOTE.—Lupins sown with grass.)

ACKNOWLEDGMENTS.

The information summarized above was collected by Instructors in Agriculture in Canterbury under the direction of Mr. McGillivray, Fields Superintendent, Christchurch ; and by Instructors in Southland under the direction of Mr. R. B. Tennent, Director of Fields Division (then Fields Superintendent, Dunedin). Our indebtedness to those farmers who so willingly supplied information is gratefully acknowledged. Thanks are due to the Assistant Crop Experimentalist, Mr. J. W. Woodcock, for analysing the questionnaire.

—*A. W. Hudson, Crop Experimentalist, Plant Research Station, Palmerston North.*

THE IMPORTANCE OF CULTIVATION IN PASTURE ESTABLISHMENT.*

P W. SMALLFIELD, Fields Superintendent, Department of Agriculture, Auckland.

THERE is nothing new in what follows—every real farmer and gardener realizes the importance of a good seed-bed at sowing-time and understands the principles and practice involved in its preparation. But at the present time there are many farmers inexperienced in cultivation work who are turning their attention to resowing their grasslands with improved strains of grasses and clovers—men whose active experience in farming has only embraced the management of established grass and the care of live-stock.

If we look at farming as it really is, if we examine the pastures that have been sown down during recent years, evidence is soon forthcoming that a great deal of the land sown in grass is not cultivated as well as it ought to be, and many farmers are not securing the full advantage of the improved strains of grasses and clovers they are now using in their grass mixtures.

Reliable strains of grasses and clovers, fertilizers, and lime can be bought ready for use—they are now standardized. Cultivation cannot be bought—it has to be done by the farmer : it is not capable of standardization. It depends on the skill of the operator, his tools (horses and implements), and time. Experience leads to the belief that the most pressing need in grassland improvement at the present time is for research work in cultivation and crop rotations to form the basis for advice to farmers in preparing land for grass.

SEED-BED FOR GRASS.

A good seed-bed for grass should be clean, sweet, moist, fine, and firm at the time of sowing, for these conditions favour rapid and complete establishment of grass and clover plants. Possibly freedom from weeds and aeration are not as important as for annual crops. Grasses and clovers can eventually suppress most undesirable

* **Paper presented at 1934 Conference of the New Zealand Grassland Association.**

plants, but weed competition at the time of actual establishment is often a disadvantage; aeration in relation to grass and clover establishment is possibly not as important as with annual crops, for both grasses and clovers seem to be more adapted to a settled condition of the soil than cereals or fodder crops. But for grasses and clovers it is essential that the seed-bed be moist, fine, and firm and the seed sown whilst the land is warm.

Moisture and warmth go together. The autumn is normally the best time for pasture establishment, and this necessitates that seed-bed preparation should be accomplished so that the land is moist at the time when the grasses and clovers ought to be sown. With late preparation a dry bed usually results, and sowing has often to be delayed until the late autumn when really heavy rains have sufficiently moistened the land to render it fit for sowing, whereas with a moist bed light rain will bring up the grass and then the reserves of moisture in the soil will be sufficient to carry on the plants

Fineness is important, and should go deeper than surface pulverization — it is the under-part of the seed-bed that should be fine. A fine surface with clods underneath is unfavourable to growth. The clods bridge open spaces and thus prevent the rise of moisture from below. When the clods crumble down, as they ultimately do, the seed-bed lacks the firmness requisite for good growth.

Firmness is essential for the full germination of grasses and clovers: clovers particularly require a really firm seed-bed. Natural settlement before sowing is undoubtedly preferable to artificial consolidation. With the former the soil firms from below up; with the latter the soil is made firmer at the top than below.

The importance of moisture, firmness, and fineness in the seed-bed for grass is nowhere more strikingly seen than in the cultivation of poor land.

The Cultivation of Gum Land.

The gum-land soils occur in patches right through North Auckland. The soil is a grey silt or a clay on undulating treeless downs rising occasionally into low hills. The surface covering consists of manuka, bracken, fern, and danthonia, and, where the drainage is poor, of swamp vegetation, rushes, and umbrella fern. The surface soil, being deficient in humus, is very sticky in the winter and bakes very hard during the dry summer weather. Cultivation is accordingly difficult and costly, as the land can be ploughed and satisfactorily worked down only in the late autumn and early winter and again in the late spring and early summer. In addition to the low natural fertility of the soil, the grassing of the gum-land areas has been rendered still more difficult by the operations of gum-diggers. The ground was roughly dug up wherever gum was suspected to exist, and a thin layer of topsoil, generally only a couple of inches thick, was buried a foot or more down, and deep holes were dug and left unfilled. But what led to the worst destruction of the soil was the continual burning-off of the covering scrub. The gum-digger did not cut down and clear away the vegetation on the surface of the ground he wished to clear: he resorted to the simple method of "putting a match to it." Fires started to clear a few yards often swept thousands of acres. This repeated burning-off caused every vestige of dark surface-soil to disappear and left a bare clay soil on extensive areas

of gum land. Unpromising it certainly looks in its unimproved state, but experience has shown that with drainage, careful cultivation, the use of perennial strains of grass and clover, and the application of adequate quantities of phosphates and often of lime these unpromising soils can be satisfactorily grassed. Cultivation is very important; without a moist and firm seed-bed and early sowing white clover will not establish, and without white clover rye-grass will not grow. In preparation for grass the best practice is to clear and burn the surface covering, fill holes, and drain wet places, plough in the autumn with a short-breasted plough, leave fallow over the winter, harrow, replough in the spring, and keep the surface harrowed over the summer, and sow grass in February or early March. The two ploughings give an excellent seed-bed—the bottom is firm and moist—firm with natural consolidation, and this firm and moist bed allows of early sowing, and a good grass and clover cover is secured before the winter; and the first grazing can be done before the land is really wet.

How easy it is to write "The two ploughings give an excellent seed-bed." If pens were ploughs and fields were paper, how easy it would be to grass these intractable clays. The land is best twice ploughed. Think of the work for that first ploughing on badly dug-over gum-land clays—where the surface consists of great spits of clay left jumbled together by the gum-digger, shallow and deep holes filled with water, and a profuse growth of rushes. First comes the clearing and burning; then the spade work to drain, to level mounds, and fill holes so that a reasonable surface is prepared for the horses and plough to work on. Then the first ploughing, with the horses slipping and stumbling over clods and through holes, dragging the plough where it would not seem possible for a plough to go. At the first turn over the land looks anything but promising. Rough the ploughing certainly is, with yellow and white furrow slices, devoid of any dark humus, turned always to the weather. But the roughness is an advantage—the ameliorating effects of the air and rain are offered full play: the clods soften as the air and water reach all parts. Time plays its part. The work cannot be hastened; it must be left to the weather. In the spring the land is harrowed and the clods break down. The second ploughing is easier than the first. The plough is the best implement for preparing a seed-bed This second ploughing provides that necessary pulverization for the bottom of the seed-bed and leaves the land in that moist and firm condition underneath which is so necessary for grass and clover establishment.

The Cultivation of Pumice Land.

Pumice land is light and sandy and the very opposite of the gum-land clays. Yet, like the clays, it is of low natural fertility, and its cultivation, although much easier than the cultivation of the clays, must be properly performed to get a good establishment of grass and clover. Time must be availed of to consolidate the clays, whilst the roller must be used to firm the pumice soils. Open plains of pumice land occur in the central plateaux of the North Island; the porous sandy soil gives rise to semi-arid conditions, and the surface covering consists of tangled scrub and tussock.

In grassing this country the surface covering is first cut and burnt, the land ploughed with a lea-mouldboard plough 5 in. deep (the better the ploughing the easier the subsequent seed-bed preparation), then left fallow for a few months to allow of weathering and aeration and for the furrow slices to close together. The land is then rolled on the furrow with a Cambridge roller, double disked, chain-harrowed to level the surface, rolled before and after seed-sowing.

Rolling on the furrow with the Cambridge roller is important; this rolling consolidates the bottom of the seed-bed and brings the soil moved by the plough again in close contact with the unmoved subsoil, making a continuous firm layer of soil through which moisture may move from the deeper layers to the surface. If pumice land is not consolidated white clover will not establish, and without white clover rye-grass will not grow. This is clearly seen on steep hillsides where the roller cannot be used.

The Cultivation of Peat Land.

Peat land varies considerably in texture and moisture-holding capacity. Some areas have silt with the peat and are reasonably easy to grass; other peat land is composed almost entirely of vegetable matter, contains a waterproofing material, and only becomes wet after months of wet weather. Peat lands are primarily grassed by surface-sowing Yorkshire fog and *Lotus major*, two plants that do well on the land immediately after drainage.

Let us take now a peat swamp of poor quality that has been drained and is now covered in the original Yorkshire fog and *Lotus* pasture, which is to be ploughed and sown in better grass. With loose, poor dry peat, work it how you will with ordinary tillage implements and you cannot get it sufficiently moist and firm for early autumn sowing. Sow early, the establishment is poor and the thinly set grass and clover plants are crowded out with weeds; wait till the land is sufficiently moist and it is too late to sow. Yet with early sowing the strike and establishment may be quite fair near gateways where very heavy consolidation has taken place.

Lessons from the Cultivation of Poor Land.

A good primary establishment is all-important in grassing land of low fertility. If the land will hold moisture and the establishment is good, the pastures can be made by building up the fertility with top-dressing. (Consideration is being given only to high-rainfall districts.) Rye-grass is easier to establish than white clover, but without white clover rye-grass will not grow, top-dress how you will. Unless a good white clover establishment is secured there is the almost certainty of losing the whole cost of cultivation, seed, and fertilizer.

Is the position very different on land of better fertility? How often do we see in newly-sown pastures the improvement in establishment that occurs from accidental causes—the better establishment near gateways and on headlands, in the wheel-marks of tractors or lorries, in the footprints of horses, in the beneficial effect of a fallow where part of a field has been ploughed and fallowed longer than another part.

After establishment, stock and top-dressing make a pasture—with good and early establishment stocking can be earlier and heavier, and

it is no exaggeration to say that a pasture is made or marred in the first six months. It seems probable that many pastures that are now being sown on dairy-farms will turn out to be only 100 lb. to 120 lb. butterfat per acre pastures, whereas with better cultivation and better management they would be capable of producing 175 lb. to 200 lb. of butterfat per acre.

Pasture Establishment on Dairy-farms.

Let us now turn and see how grass is often put in on dairy-farms. A farmer has been cutting his top-dressing somewhat short during recent years and finds he is not now getting the grass-production that will provide sufficient summer grazing and give a surplus large enough for hay and ensilage to keep his stock going during periods of low grass-production. After being caught short one winter he decides to break up a field of his poorest grassland for a crop of swedes for next winter, and, as he has heard much about certified rye-grass, he expects to get a really good pasture when he sows it down later to grass—one that will give a full return for the fertilizer he applies in top-dressing. He ploughs his land early for swedes, for he knows he has to let the turf rot and the land consolidate if he is to get a crop. Now, after the swedes usually one of two things is done—he either takes a green crop or a soft-turnip crop for summer feeding and sows grass almost immediately after ploughing the land following the summer crop, or he leaves the land after the swedes untouched until February or early March, and then ploughs, works down, and sows the grass all within a week or two. With light land the seed-bed is often too loose, for he does not roll on the furrow, because the usual roller requires five horses for rolling on the furrow and he has only three. With heavy land the seed-bed is usually cloddy and loose below because the seed-beed has been hastily prepared. With both types of land the seed-bed is usually dry, and sowing is delayed until some really heavy rains have fallen.

Now, if matters are to be improved certain questions deserve consideration. Are we in the high-rainfall districts to rely wholly on grass for feeding cows? If so (and it is certainly the cheapest and easiest way), then grass is our crop, and all care should be taken in the cultivation for that crop. When it comes to renewing grass my experience is that the best establishment is secured by ploughing old grassland, summer fallowing, and sowing to grass again early in the autumn.

If annual forage crops are to be grown as an essential feature of dairy-cow feeding, are they to be rotated with temporary or long rotation grass? What rotation will give the best results for grass-sowing? (Regular annual forage crops on dairy-farms mean extra labour and equipment. The slogan of "Better Feeding of Dairy Cows" was not taken up as long as better feeding meant annual forage crops, but was quickly incorporated into farm practice when it meant the saving of grass ensilage.)

To come back to cultivation: A dairy-farmer has usually only two or three light draught horses, and the implements used must be adapted to the horse-power. For light land a roller is essential—the land must be rolled in the furrow: the dairy-farmer requires a Cambridge roller 3 ft. 6 in. to 4 ft. wide so that he can roll in the furrow with two horses.

On heavy land pulverization and consolidation should be brought about with the plough. The work that is done on large arable farms with heavy grubbers and Cambridge rollers should be performed with two ploughings, for there is no better pulverizing implement than the plough. At present farmers use the disks to give a superficial pulverization, whereas two ploughings give a complete pulverization and a good bottom to the seed-bed.

Summary.

The seed-bed for grass should be firm, moist, fine, and warm at the time of sowing. These conditions are particularly well emphasized in grassing poor land, on which, if the seed-bed is not exactly correct, the grass may fail completely. Accidental happenings, such as the better strikes secured in tractor or lorry-wheel marks, indicate that the seed-bed for grass, even on good land, is often not as well prepared as it might be. Cultivation operations—their method and time—are intimately connected with farm-management. On dairy-farms the definition of the procedure to get land ready for grass depends on whether farms are to be purely grass farms or whether grass is to be supplemented by annual crops. The actual cultivation of land for grass should be performed thoroughly with implements suited to the horse-power available.

TARANAKI FARMERS' HAY AND SILAGE COMPETITIONS.

SEASON 1933-34.

J M. Smith, Instructor in Agriculture, Fields Division, New Plymouth

The judging of the hay and silage classes in the field competitions organized by a committee representing the Taranaki Agricultural Society and the North Taranaki Farmers' Union has now been completed.

The total number of entries in these classes is the largest in the history of the competitions, there being 351, made up as follows: Stack (grass), 103; stack (A.O.V.), 7; stack (hillside), 18; concrete pit, 17; earth pit, 56; hay, 150: total, 351.

This increase indicates the value put on the competitions by farmers throughout the district. As a practical means of gaining experience and of avoiding the mistakes that have been made by others the competitions in these classes do a great work.

Crops.

Ninety-six per cent. of the silage made in Taranaki this season was from pastures, the remaining 4 per cent. being chiefly oats and millet. Very few special crops are grown for the express purpose of making them into silage, but these crops are being employed mainly in the preparation of the ground for permanent pasture, and as a matter of convenience for feeding they are saved as silage. As the area in first-class permanent pasture in Taranaki increases, so will the quantity of silage made from special crops decrease. Farmers

generally recognize that one of the present weaknesses in their pasture management is in the comparatively poor utilization of the peak pasture growth, and there is little doubt that the making of silage is a farming operation that lends itself to the better utilization of surplus grass.

The quality of the raw material governs to a large extent the quality of the resultant silage, for it is impossible to make a high-class silage from an inferior pasture. The actual points allotted for raw material (20) do not indicate truly the influence that the raw material has on the silage, but it must be remembered that the competitions in these classes are for silage and not for pastures, so that to place the proper proportion of points on raw material would unduly favour those farmers with first-class pastures. At the same time, the competitions should encourage the making of some of the best growth on the farm into silage, and not the following of the practice that is in vogue in some districts of making all of the first-class pasture into hay and making silage only from the inferior pasture and weed growths. Such silage cannot be expected to give satisfactory results, particularly with milking-stock.

Stage of Cutting.

Stage of cutting, next to raw material, has the greatest influence on the quality of the silage, and if the competitions have done nothing else but demonstrate the benefits of early cutting, then they have been well worth while. The aim in cutting should be to catch all of the grasses and clovers at their best stage, but the dominant species in the sward should be the guiding factor. In a high-production sward this will probably be the perennial rye-grass. Farmers who have cut pastures for silage in the varying stages of growth are unanimous in their opinion that the best silage results from the crop being cut at a leafy succulent stage. In regard to the quality of the resultant silage there is also a greater margin of safety from mismanagement when the crop is harvested at a leafy stage. During the past season the necessity of having a sappy crop to deal with was brought home in quite a forceful manner. The spring months were, for Taranaki, comparatively dry, only 8¾ in. of rain falling during September, October, and November. Just about the time for the growing silage crops to develop we had eighteen consecutive days without rain, and this resulted in a less sappy crop than normally. This in turn was reflected in much of the silage, which, on account of lack of sap, was cured at too high a temperature, and came out of the stack quite dark in colour. This same effect is noticeable where the crop is allowed to go past its best stage for silagemaking.

Despatch in Harvesting.

While it is important to cut the crop at a sappy stage of leaf growth, it is also necessary to get the raw material quickly into the stack so as to conserve the succulence of the growing crop. This rapid harvesting is particularly desirable where the crop has gone past its best stage before cutting. So seized are some of the competitors of the importance of this phase of silagemaking that they actually employ an extra team so that the crop is mown just in front of the

sweeps and it is only a matter of minutes before the material is harvested. While this is doubtless desirable where the team unit is sufficiently large to enable it to be carried out, it is hardly necessary to engage special teams to enable mower and sweep to work at the same time. Nevertheless, the available team should be employed so that the green material does not lie for more than an hour or two at most before being harvested even if it means changing the team from sweep to mower as many as three times in the day. If the weather is at all drying—that is, hot and windy—the wilting of the green material is very rapid and every hour out means an inferior silage. There are times, however, when some wilting is considered advantageous, and one of these is when an extremely sappy crop such as lucerne or oats, &c., is being dealt with. Then, again, if the silage is being made in a pit, the wilting of the first day's filling will obviate that rank sour undesirable silage that one frequently finds at the bottom of a pit. It will be noted that all of these operations—*i.e.*, cutting at a sappy stage and rapid harvesting—aim at a low-temperature silage, and there is little doubt that the competitions have clearly indicated in a practical manner that for milking-stock this comparatively low-temperature silage is the silage at which to aim. This does not mean a dark-green objectionably sour material, but the golden-green fruity type of silage. Investigations into complaints about silage from various sources have invariably led the investigator to an undesirably sour type of silage or to the dark-brown burnt type. At no time has the fruity green type been found responsible for any trouble.

Building the Stack.

There is little to be added to the evidence of previous seasons in regard to building the stack. Continuous building is desirable where mechanical means of hoisting the material are available, but if through force of circumstances it is necessary to fork the material on to the stack, then the resting of the stack between the days of building reduces labour considerably. The round versus the square stack controversy continues to rage, but it is of little moment. If a builder feels more competent to build a square stack, he should do this ; and if, on the other hand, he is more at home with the round stack, let him build a round one. If, however, he is at home with either, then the round stack should prove the better. Again, the keeping of the stack fairly full in the centre is now in favour, but it is advisable to be careful not to overdo this, or a dwarfed wall with large shoulder waste will result. The walls should be firm and upright and should not be sprung—they themselves will do all the springing necessary. Hard raking or hard pulling of the walls is very desirable, but they should not be cut back.

Filling the Pit.

A mistaken idea exists in some quarters that where a hillside pit or concrete pit is being used for the conservation of silage any building of the material can be dispensed with and the grass just thrown in. Such an idea is quite wrong, as many competitors have found to their sorrow. Almost as much care and attention needs to be paid to the building of the material in the pit as is paid to it in the stack. It is an advantage to keep the centre full and in some cases high, but the

walls must be well packed and tramped. A hollow centre draws the material away from the sides as it settles, while a full centre with loose walls means that the sides sink more rapidly than the centre, with the result that they too are drawn away from the walls. Continuous filling of the pit is not altogether advisable in that the temperature rises more slowly in the pit than it does in the stack and rapid filling often results in a too sour silage. Then, again, the matter of building above ground is a decided drawback of the pit, and slow filling means more material can be put into the pit before it is necessary to build above ground. Where it is necessary to build any height above ground-level it will be found an advantage to put a slight bevel on the lip of the pit to ease the passage of the stack portion of the green material into the pit. An alternative to this bevel is to gradually increase the size of the stack as it proceeds above the pit, but this system is leaving too much to chance and the bevel is certainly the surest method. Earth pits continue to be quite satisfactory, providing the walls are smooth and do not crumble unduly. This is where the concrete pits are superior to the earth pits in their degree of permanence. The damp earth wall also creates more mould round the walls of the silage than does the concrete. Another drawback to the earth walls is the amount of damage done by mice.

Covering the Stack.

Temperature is controlled by the exclusion of air, and this takes place in the first and subsequent sections built by the addition of more material on top. Following the last day's harvesting, it is necessary to exclude the air from this section, so some weight is put on top to bring this about. Usually soil is used, although at times boulders, concrete slabs, &c., are employed. Just as continuous building excludes the air and controls the temperature, so should the soil be put on straight away to control the temperature in the top section. The depth of soil will depend upon the weight of soil. For instance, in the Uruti district less heavy silt need be used than in, say, the light pumice soil of Inglewood. As a rule, however, 1 ft. to 18 in. of soil should suffice. The important thing about the soil, however, is to get it right out on to the edges of the stack to ensure good weight on the walls, which should reduce wall waste considerably. Many and varied are the means employed to bring this about, and the palm must go to the Okato district, in which short heavy logs anchored to a central peg are employed. The logs themselves are heavy, and being some 15 in. in diameter allow a big depth of soil to be brought right out. In the case of Mr. H. T. Paul's oat-stack the maximum points for cover were given, it being impossible to suggest any prospective improvement, even in a minute way. Occasionally boulders are used, and these are very successful where the stack is heavily consolidated during building. An example is the case of Mr. L. Marsh's stack at Hillsborough, where the teams actually come up on to the stack with each load, and where a very high degree of consolidation is effected—here the boulders act equally as well as does the soil in other cases. Where consolidation is not all that could be desired, however, boulders sink into the stack causing depressions into which water finds its way, resulting in much waste.

Stack Silage.

Of the 103 entries judged forty-seven gained over 90 points. The Fertilizer Co.'s Cup for this class was won by Mr. H. Jones, Kaimata. This stack was made from a sixteen-year-old pasture composed chiefly

of paspalum at the time of cutting on the 26th January. This paddock was not shut up until December, so that the short quick growth of the paspalum, together with a certain amount of clover that was present, constituted a very fine leafy raw material which was saved in a splendid manner. The stack was a round one, being 21 ft. in diameter and 8 ft. high. It was put in during three consecutive days, the material being cut twice daily. It is interesting to note that the weather was showery at the time, the men working in overcoats for a considerable portion of the time, and this fact, together with the sappy nature of the young paspalum-clover mixture, was no doubt largely responsible for the splendid quality of the silage and the small amount of waste. The soil was put on straight away and was 14 in. in depth, while it was held in place by manure-bags.

Six other competitors scored 94½ points for second place, indicating the closeness of the competition in this class. Mr. W. J. Bridgeman, Okato, had a stack from pasture nine years old cut on the 25th November and harvested in three consecutive days, 18 in. of soil being put on straight away. The material from a three-year-old pasture of Messrs. Clemow Bros., Cardiff, was harvested in six consecutive days during showery weather, and 1 ft. of soil put on straight away, being held out with netting. In the case of Mr. A. N. Mills, Cardiff, an eight-year-old pasture was cut on the 20th December and harvested in four days with one day missed on account of wet weather. Eighteen inches of soil was put on straight away and was held on by poles. Mr. J. Kilsby, Tariki, cut on the 30th January and harvested in three consecutive days from a five-year-old pasture. A foot of soil was put on straight away, was held out with rushes, butts out. Mr. R. B. Sutton, Inglewood, harvested on the 23rd November, putting the material in during four consecutive days, while 15 in. of soil put on straight away was held out by sods. At Uruti Mr. D. S. Musker harvested a twenty-year-old pasture, commencing to cut on the 8th February. It was harvested in four consecutive days, while 1 ft. of soil was put on straight away and held with netting. It is interesting to note the dates of cutting of these various entries, which are as follows: 20th, 23rd, and 25th November, 20th December, 26th and 30th January, and 8th February. This indicates that the season of the year has relatively little to do with the quality of the silage, but the stage at which the crop is cut is the determining factor. The term "early cutting" conveys to some the impression that the material should be cut early in the season, but "early cutting" really means comparatively early in the stage of growth of the crop.

Stack Ensilage (other than Grass).

This class was won by Mr. H. T. Paul, Okato, whose stack scored 97, the highest points yet awarded in the competitions. The crop was oats, and this was cut with the binder on the 3rd and 4th January, and the sheaf-stack built in the same manner as a grain-stack. The stack was 32 ft. in diameter and 7 ft. high. The material was harvested in three consecutive days, and, as the weather was hot and drying, the sheaves were stacked in heaps in the paddock to prevent too much wilting. Two feet of soil was put on straight away, and this was held out by the short logs already referred to.

Mrs. Ashley, Okato, was second in this class with a stack very similar to Mr. Paul's, only the quality and covering was very slightly inferior to the winning stack.

Hillside Stack Silage.

The Blyde Bros. Cup for this class was won by Mr. W. Summers, Tariki, this same competitor being runner up in this class last season. The crop of grass was from a paddock three years old and a start was made with harvesting on the 1st December. Actually fourteen days were occupied in harvesting with odd days missed in between, while the soil was put on straight away.

Concrete-pit Silage.

The competition in this class was exceptionally keen and the high standard of points indicates the fine art that those competitors saving silage by this means have brought this to. Mr. P. A. Openshaw, Lepperton, won the Bell Cup with a total of 96¾ points, while Mr. G. H. Bell, Oakura, and Mr. E. C. Locke, Hillsborough, each scored 96½ points.

Earth-pit Silage.

This class also saw very keen competition, there being more entries than usual. Mr. J. H. Paulger, Tikorangi, won the Clements Cup awarded for earth-pit silage with a total of 96 points, while Mr. E. Mahon, Tariki, scored 95½ points, and Mr. G. B. Knowles, Tariki, Mr. D. S. Musker, Uruti, and Mr. F. Bracegirdle, Kaimata, each received 95 points.

Hay.

This was a particularly strong class and the standard of hay was higher than has been the case during the past few years. Weather conditions were fairly favourable when the crops were at their best and hence there was no undue delay in cutting by having to wait for the weather as there is in most years. The winning stack of Mr. R. Cassie's at Okato was a beautiful sample of clean well-saved hay, there being a splendid variety of grasses and clovers present.

In an endeavour to obtain a further alternative outside market the United States Government was again approached with a view to endeavouring to obtain admittance of New Zealand apples and pears into its country. Previous efforts had failed owing to the market conditions imposed in the United States against countries whose fruit was liable to be affected with the Mediterranean fruit-fly, this being extended to New Zealand (where this fly does not exist) on account of the fact that importations of fruit from other countries where the Mediterranean fruit-fly was present was permitted by New Zealand. After a period of negotiations an Order in Council was enacted prohibiting the importation into New Zealand of fruit from any country where the Mediterranean fruit-fly existed, and, as a result of this, the United States market was made available for us. Circumstances have prevented any large quantity being exported there during the present season, but as a result of the visit to Washington and New York of Mr. Campbell, Director of the Horticulture Division, it is anticipated that the United States market will be thoroughly tested out next season.—*Report, Director-General of Agriculture.*

SUCCESSFUL GRAZING OF PASTURES IN SHEEP-FARMING.*

THE DEVELOPMENT OF THE TITIPUA BLOCK.

W. E. HUNT, Invercargill, and A STUART, Instructor in Agriculture, Invercargill.

AN area of 5,500 acres in extent, of which 1,500 acres is leasehold, known as the Titipua Block, was acquired by Sir William D. Hunt in 1928, at a nominal figure. This block is situated approximately five miles north-west of Dacre and is twenty miles by road from Invercargill. It is bounded on two sides by an afforestation area, as the land has been deemed unsuitable for agricultural or pastoral purposes. The district is undulating or rolling country, for the most part ploughable, with red tussock dominant. Areas which had been cultivated and grassed by the original settlers had rapidly reverted to stunted brown-top, and these settlers in many cases had been forced to quit their holdings after losing their investments. From this it may be deduced that the area may be rated definitely third class, and the carrying-capacity placed in the vicinity of one sheep to every 2 acres.

For the past five years an average of 300 acres per annum of this block has been sown to grass, and to-day some 1,500 acres are carrying fine swards of perennial rye-grass and white clover. The method of management is described briefly in the following statement :—

The land is ploughed in the spring and a crop of swedes or turnips taken, 1 ton of carbonate of lime being applied previously to sowing, and the crop sown with 4 cwt. per acre of a proprietary turnip-manure. The swede crop is fed off in breaks by sheep having a run-off on to pasture (ewes being fed for a month and hoggets for two months) ; the yields average between 40 to 50 tons per acre. In the following spring grass is established with a nurse crop of oats, and at establishment 3 cwt. per acre of superphosphate is applied. Following the harvesting of the oat crop a second ton per acre of carbonate of lime is applied in February. The subsequent manurial treatment has consisted of the application of 2½ cwt. per acre of superphosphate in January to February. Up to the time of writing no further lime has been applied, and on the older pastures, which are now approaching six years of age, there is as yet no apparent need of a further dressing.

In the grass mixture sown, only the finest seed available has been used, and in all cases preference has been given to certified seed. In the case of the white clover the opinion has been expressed by Departmental officers that this clover is up to certified standard. The composition of the mixture used is : Permanent pasture perennial rye-grass, 25 lb. ; Italian rye-grass, 10 lb. ; Timothy (New-Zealand grown), 3 lb. ; Mother cocksfoot (Akaroa), 5 lb. ; *Poa pratensis*, 1 lb. ; *Poa trivialis*, ¼ lb. ; yarrow, 1 oz. ; permanent pasture Montgomery red clover, 1 lb. ; white clover (Hawke's Bay), 3 lb. : total, 48 lb. 3 oz. The seeding of oats is 2½ to 3 bushels per acre.

For experimental purposes paddocks have been sown without nurse crops, and that the establishment in these paddocks is not

* Paper presented at 1934 Conference of the New Zealand Grassland Association.

superior to others sown at the same period with a nurse crop is the opinion of leading agrostologists who have visited and compared these fields. This is remarkable when it is considered that yields of up to 60 bushels of oats have been obtained. In passing, it is conceded that good establishment has followed from early autumn sowing.

An intensive form of controlled grazing has been systematically followed, and at no period of the year has the grass been allowed to grow beyond that stage when sheep could deal successfully with it—actually growth is never more than 1 in. in length. In this connection it has to be pointed out that surplus stock is available from the remainder of the block as yet unbroken, and consequently no provision has been necessary to conserve growth in the form of hay or ensilage. When the whole block is brought in, this problem will then arise. At this stage the effect of consolidation and heavy surface manuring effected by the intensive stocking must be taken into consideration as important factors in the maintenance of a highly productive sward.

In Southland the great majority of sheep-farmers practice "set" stocking from lambing-time until weaning, and, in the case of the more progressive, one cattle beast to each twenty ewes is included in order to give the sheep points of re-entry into patches of growth which get beyond sheep control from November onwards. These farmers, while recognizing that sheep prefer day-old grass, object to the extra labour which would be involved in the shifting of stock from paddock to paddock. From carrying-capacity figures available, these farmers winter the equivalent of five to seven sheep per acre and fatten three to five lambs per acre, of which approximately 70 per cent. are obtained fat directly off the mothers.

The above figures refer to straight-out fat-lamb production farms on medium to good country, varying in size from 400 to 800 acres; but on the Titipua Block the ewe lambs are retained to build up the flock, which is of the Romney breed. However, for comparative purposes, figures have been worked out for 790 acres of the older-established pasture, and the carrying-capacity is equivalent to 7·7 sheep per acre, allowing that five sheep are equal to each cattle beast employed. Specific particulars are that 3,331 ewes produced 3,592 lambs, which may be considered very good, as a big percentage of the flock were young ewes. Of the wether lambs 62 per cent. were fattened off the mothers by the end of February. From November to March three cattle beasts to every 4 acres were added to control the growth and prevent seeding of the rye-grass.

That the production of rye-grass culm is prevented by this method there is absolutely no doubt, but it is a moot point as to what extent the number of cattle could be reduced and sheep correspondingly increased and yet obtain the same pasture control. With the younger pastures stocking is reduced by approximately 40 per cent. until the second year, in order to allow the maximum of tillering to take place.

In conclusion, the following points deserve to be emphasized in this transformation of third-class into first-class land: (1) The heavy lime applications before and after the establishment of the pasture; (2) the use of certified strains of seed; (3) efficient grazing control; and (4) annual phosphatic top-dressing.

PIG IMPROVEMENT CLUBS.

A MOVEMENT which is getting a footing, and which promises to be distinctly valuable and economical to those participating in it, is the operation of pig-improvement clubs. Briefly, the objective of these clubs may be stated to be the introduction to the farms of members of good purebred pigs at the lowest possible cost.

The recently inaugurated Shannon Pig Club, which was founded on information obtained chiefly from Taranaki, illustrates the general nature of the activities of the clubs under consideration.

The Shannon Pig Club is limited to ten members, who elect a president, secretary, and treasurer. It is believed that a larger membership would be a disadvantage. The membership fee is £3 10s. The club intends to purchase periodically a purebred sow and litter which will be in the care of a selected custodian. The custodian provides skim-milk and a suitable site for a sty and yards which are erected by the club, and he receives 15s. for each weaner. No pig is carried beyond two months, except by special arrangement with the custodian. The weaners are disposed of, by ballot, to members at £1 10s. each. A selection committee of three is responsible for sale and purchase of stock, for selection of stock for breeding, for tattooing, and for weighing stock when three and eight weeks old. Cost of any service and cost to and from place of service is borne by the club. All membership fees are payable not later than the 31st October. No unfinancial member is entitled to any of the advantages of the club. All pigs not deemed fit for breeding purposes become the property of the custodian, who undertakes that these pigs are slaughtered and who purchases them at a price decided jointly by the club and the custodian. All pigs are supplied cash on delivery to members. A member leaving the district or giving up farming may continue as a member. Members deciding to sell their interest must sell to the club at the original subscription, payable when funds of the club allow. The majority vote of members shall be final in deciding any dispute. Any members who resign relinquish claims on the club. The above rules are given for the guidance of any other farmers taking part in the formation of further clubs.

Sterility.—Inquiry in regard to sterility goes to show that in all probability several factors are involved, falling under the headings of (1) mineral deficiency, (2) partially infertile bulls, (3) infection. Under the first heading fall those instances dependent on insufficiency of minerals in the feed, or their presence in a ratio unsuitable to the maintenance of the animal's requirements.

Reference must again be made to the necessity of better winter feeding of our herds. The nutritional aspect at this particular time must not be lost sight of, and the aim of every dairy-farmer should be improved conditions of feeding and also of shelter for his cows during the winter months.

Investigational work has shown the bull to be responsible in many instances for the occurrence of this trouble in a herd. Certain infections of the cow's genital organs are also involved.

Referring to this condition, the District Superintendent, Dunedin, who has conducted some keen observations regarding the trouble, states in his report: "There is every possibility of some dietetic factor having an influence in the production of functional sterility."

—*Report, Director, Live-stock Division.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 1st November to 29th November, 1934, include the following of agricultural interest:—

No 70663: Cow-tail holder; W. Hansen No. 70759: Flax-treating; H. Armitage. No. 71135: Yoking horses in tandem; R C Blackett. No. 71806: Cream-separator; E. S. Rogers. No. 71869: Moisture-vent for churn, Andersons Ltd. No. 71902: Curd-cutter; L. O. Bensemann. No. 71977: Hinge; M. Ferrick. No. 72587: Flame-thrower, R H. Chisholm and R E. Smith. No. 72673: Coating for cured meat, J C. Hutton Pty, Ltd No. 72674: Milk-manufacture, A Axelrod. No. 72728: Chicken-incubator; S. B. Gamble No 72750: Hay-stacker; D. S. Riddell. No. 72781: Cattle-salt holder, P. A. McHardy. No. 70778: Fungicidal bodies, Imperial Chemical Industries, Ltd.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

From information which has been compiled by the Census and Statistics Office from returns obtained from woolbrokers, woollen-mills, freezing-works, wool-scouring works, shipping companies, &c, it has been computed that the quantity of wool held in New Zealand on the 30th June, 1934, represented approximately 49,800,000 lb in the grease, as compared with 78,600,000 lb at the 30th June, 1933, and that the stocks are now lower than at the corresponding date in any of the four seasons immediately preceding.

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are estimates of the current season's lambing in New Zealand computed from estimated average percentages furnished by Inspectors of Stock. Corresponding figures for the five previous years, together with the actual number of lambs tailed therein, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1934 ..	9,524,065	88·70	8,447,643	..
1933 ..	9,318,941	91·23	8,502,050	8,385,569
1932 ..	9,170,996	89·16	8,177,657	7,988,569
1931 ..	9,247,005	86·49	7,998,247	7,813,887
1930 ..	9,312,461	83·19	7,747,274	7,710,370
1929 ..	8,820,536	87·56	7,723,523	7,817,177
		SOUTH ISLAND.		
1934 ..	8,047,361	89·88	7,232,750	..
1933 ..	7,890,756	88·14	6,955,252	6,889,128
1932 ..	7,892,064	88·42	6,978,494	7,027,059
1931 ..	8,361,724	87·13	7,285,914	7,161,104
1930 ..	8,251,714	84·43	6,967,041	6,817,939
1929 ..	7,787,619	89·87	6,998,691	7,070,422
		DOMINION.		
1934 ..	17,571,426	89·24	15,680,393	..
1933 ..	17,209,697	89·82	15,457,302	15,274,697
1932 ..	17,063,060	88·82	15,156,151	15,015,628
1931 ..	17,608,729	86·79	15,284,161	14,974,991
1930 ..	17,564,175	83·77	14,714,315	14,528,309
1929 ..	16,608,155	88·65	14,722,214	14,887,599

District Estimates.

The following table gives estimates of the current (1934) season's lambing for the several sheep districts :—

Sheep District.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.
Auckland..	1,877,835	88·69	1,665,390
Hawke's Bay - Gisborne ..	3,936,913	84·42	3,323,537
Wellington - West Coast ..	3,709,317	93·24	3,458,716
Marlborough-Nelson-Westland	758,536	78·70	596,948
Canterbury-Kaikoura ..	3,480,236	89·69	3,121,461
Otago (including Southland)	3,808,589	92·27	3,514,341
Dominion	17,571,426	89·24	15,680,393

—*Live-stock Division.*

Recently at Bushy Park Estate there was a most striking example of the beneficial effect of a legume crop on the succeeding crop. One-half of a field contained peas last year, the other half kale, which was fed off. Oats were sown this spring. Where the peas were, the crop is a beautiful dark green with a most luxuriant growth, whereas the remainder of the crop where the kale was is just normal.

SEASONAL NOTES.

THE FARM.

Preparation for New Pastures.

PASTURES which are intended to have such a long life that they are termed "permanent" are our most important crop. Advances in our knowledge about pasture strains and about top-dressing enable a greater length of life to be more readily and certainly associated with continuous high production than was previously possible. Any initial weakness is likely to affect production detrimentally throughout the whole life of the pasture. Because of these three facts, the task of establishing permanent pastures is one of the most important in New Zealand farming, and one which warrants much greater attention than at times it receives.

Poor results in the establishment of permanent pastures are generally due to one or more of the following causes: (1) sowing on poorly tilled land; (2) use of unsuitable seed; (3) sowing at an unsuitable time. In the case of pastures sown in the fall, sowing on poorly tilled land and sowing at an unsuitable time both usually may be traced to starting preparatory cultivation at too late a date. For full success the seed-bed for permanent pastures needs to be in a fine, mellow, and firm rather than in a loose lumpy condition. To secure the desirable condition, the cultivation of land to be sown in permanent pasture in the fall should now be kept in view. Hurried tillage eliminates the natural weathering of the soil, which has been shown by experience to be of much value in the economical production of a fine, firm seed-bed. The special need that exists for a fine, firm seed-bed arises partly from the really minute size of the vital parts of seeds of some of the more important pasture plants. There are about a quarter of a million rye-grass seeds and three-quarters of a million white clover seeds to the pound, and as a substantial portion of the pound is represented by seed-coats, it may be deduced that the vital parts in each seed are so minute that any process of covering them on uneven, lumpy ground must necessarily bury many of them so deeply that they are quite unable to send their shoots up into the light. The firmness of seed-bed that comes with fineness, apart from favouring even covering of the seeds, seems to beget vigorous root development. Even on the heavier soils that naturally consolidate relatively readily, failures which farmers at times are inclined to attribute to their being supplied with faulty seed are found, on inspection, to be due to a loose condition of the seed-bed—a good "strike" may be noted where there has been additional consolidation—*e.g.*, in hoof-marks or in wheel-tracks or at headlands, while similar seed has failed on the major and looser portion of the field.

If pasture is to follow an arable crop, it is often sound practice, provided the land is reasonably clean, to disk rather than to plough—the greater firmness of seed-bed given by the disking may be an advantage, and additional fertilizer, provided by the animal manure, is retained near the surface, where it most readily benefits the young pasture plants.

As the seed used is of basic importance, it is unfortunate that three weaknesses in respect of seed mixtures are of common occurrence. Firstly, at times, the amounts of different pasture plants included in the mixture are not in accord with those suggested as suitable by field experience; sometimes money is spent on seeds of plants which are not worthy of a place in a mixture; and sometimes seeds of plants which are of considerable value in specific circumstances are omitted in such circumstances. Secondly, suitable amounts and kinds or species of seeds may be used, but strain

differences within a species may be ignored, with consequent marked inferiority in the resultant pasture. The great benefit of employing a good strain of perennial rye-grass is now widely recognized, but it does not seem to be so widely understood that analogous benefit is to be secured from the use of superior strains of clover and of cocksfoot. The only sure way of exploiting recent advances in our knowledge relative to strain differences within pasture species is to use certified seed. Thirdly, the use of suitable species and strains of seeds in appropriate amounts is not sufficient to ensure a satisfactory seed position unless care has been taken to obtain seed of good germination capacity, vitality, and purity. The report of the Seed Analyst which appears on another page provides interesting information about variations relative to germination and purity which were noted last year when there were no marked departures from the normal average position. The report contains abundant evidence that within the one district in the one season there were, as usual, substantial variations in germination capacity which indicates that price comparisons alone were very imperfect guides in the purchasing of seeds. The report also contains evidence that lack of caution in purchasing seeds would at times lead to the inclusion in the seed mixture of seeds of such plants as Californian thistle, ragwort and ox-eye daisy—*e.g.*, a normal sowing of cocksfoot and dogstail in a mixture for an acre might have included 4,480 seeds of Californian thistle. Many of the faults commonly characterizing pasture seed-mixtures may be avoided by seeking advice from district officers of the Fields Division. As time may be required for proper attention to some of the matters calling for consideration, the purchasing of seed for permanent pastures should not be made in the hurried manner which is necessary when the selection of seeds is deferred until just before the seed is to be sown. Hasty purchase of seed is likely to be haphazard, and not based on as full a knowledge as is desirable in respect to such important matters as the strain and germination of the various lines of seed available.

The date of sowing of pastures in the autumn fairly frequently is too late. In many parts an element of danger attaches to any sowings later than March—occasionally, of course, sowings which would be too late in the majority of a series of seasons are quite successful, and because of this such late sowings are carried out generally and the number of relatively poor results that necessarily ensue are attributed to anything but the real cause, which is the bad management that is involved in risking the dangers attaching to late sowings. It is widely known that clovers are likely to suffer in late sowings, but it seems not to be so generally known, although it has been well demonstrated, that the development of rye-grass and other plants in late sowings is at times subject to great checks from which it is doubtful whether the sowing ever fully recovers.

General Pasture Work.

Unless recently top-dressed fairly liberally, pastures from which hay or silage has been saved may be expected to react profitably to a dressing of superphosphate applied as soon as the mown material has been removed. Such top-dressing is likely to be useful irrespective of the stage of growth at which the pastures were mown, but pastures mown in a leafy stage have more vigorous aftermaths than similar ones mown at a later, somewhat stemmy, stage. The former usually give the greatest direct return from top-dressing as suggested, but pastures mown at an overmature stage are frequently weakened, and so are in especial need of the strengthening provided by the top-dressing.

Not generally, but occasionally, it proves advantageous to allow thinned deteriorated pastures to run to seed in summer, provided such pastures contain satisfactory numbers of useful plants which it would be beneficial to increase in number by reseeding. If such reseeding takes place, the

pasture should be well harrowed in the autumn when the seed has ripened and when rain sufficient to allow of safe establishment of seedlings may be expected. Under favourable circumstances such management may usefully lead to thickening of swards, especially when ploughing of an open weak turf is either not possible or not desirable. However, it is advisable to keep in mind that if the desirable species which it is sought to increase have declined because of unduly low fertility, then reseeding will fail to bring about a permanent increase in their numbers unless the fertility is suitably increased by appropriate top-dressing or by other effective measures. Further, as a means of obtaining improved swards, repairing of weakened swards by reseeding is frequently an inferior alternative to ploughing and eventual regrassing.

Apart from areas for special seed-production, generally precautions should be taken to obviate the production of seed by recently sown pastures during their first year, and such precautions are particularly advisable if the young pastures are permanent ones containing slowly developing as well as quickly developing species. Seed-production by young pastures of this type is likely to lead to harm of the valuable, more slowly developing species. When young pastures cannot be controlled adequately by the stock available, topping with a mower should be employed.

Utilization of Summer Feed.

At times the best possible returns from special feed grown to supplement the pastures in summer are not obtained because a commencement with the use of the feed is not made early enough. In dairying, such special feed should be used not in remedying the position after an avoidable drop in production has taken place, but in preventing the occurrence of such a drop. Over wide important dairying areas this means that the use of special feed should be commenced shortly after Christmas, and this notwithstanding the fact that in such districts many consider it unnecessary to do any special feeding of producing dairy stock until about February.

Because of the prevalence of stemmy feed in summer it is well to remember that such feed is far from ideal for young developing stock. Actually growing stock such as calves develop well only when they receive highly digestible feed relatively rich in the materials required for the formation of muscle and bone—materials in which stemmy feed is dangerously poor and in which leafy feed is relatively rich.

In carting out special feed such as soft turnips, it is generally advisable to scatter it well over the field in order that no portions become injuriously fouled with droppings, but if the fertility of a particular area requires building up, then it may be advisable to concentrate the feeding out on that area, which should be harrowed fairly frequently when suitable opportunity arises.

General Cropping Work.

If the sowing of turnips and swedes has not been completed by the end of December, as a rule, it should receive attention as speedily as possible. When rainfall is good, sowing may continue into January, but in most places after the middle of January it is much safer to sow turnips than swedes—turnips not only develop more quickly than swedes, but also suffer less from insect pests which at times, especially in dry seasons, appear in summer and autumn. Hardy Green Globe turnips are suitable for January sowing.

If the weather allows of the desirable preparatory cultivation, it is at times useful when additional winter feed is desired to sow in the late summer or early autumn, on land not yet broken out of grass, a temporary pasture mixture consisting of 25 lb. to 30 lb. of Italian rye-grass and 4 lb.

to 6 lb. of red clover an acre. If the temporary pasture is likely to occupy the land for less than a year and quick production of feed is especially desired, then half of the Italian rye-grass may usefully be replaced by an equal amount of seed of Western Wolths rye-grass.

When the land available for late summer or autumn sowing will be required in the spring for another crop it may prove well worth while to grow a cereal catch crop such as oats or black skinless barley—both of which are usually sown at the rate of about 2½ bushels of seed an acre. Such cereal catch crops, under favourable conditions, yield considerable winter and early spring feed, and in the spring may be followed by roots or other suitable crops.

Often the fullest possible returns are not obtained from temporary pastures or cereals sown for winter feed because the crops are sown too late—this applies especially to the South Island. With such crops a dressing of 1 cwt. to 3 cwt. an acre of superphosphate is usually quite profitable. The likelihood of success with the crops mentioned above is lessened if there has not been thorough preparatory cultivation.

Often, if necessary, lucerne may be sown with success in January, but on the basis of experience sowing in November and December is generally preferred. Lucerne-seed is relatively small, and, because of this, it should not be sown at a depth greater than 1 in. If there is likely to be sufficient soil-moisture to allow of superphosphate exerting its fertilizing influence, then it is often good practice to top-dress established lucerne with superphosphate after it has been mown, about midsummer.

Ordinarily potatoes profitably repay considerable attention at this season. In addition to being kept free from weeds by suitable cultivation, they usually will need to be moulded up and possibly to be sprayed for late or Irish blight. It is particularly desirable to utilize such spraying as a preventive rather than as a remedial practice. As a rule, cheaper and more effective spraying results from the use of sprays prepared on the farm instead of purchased ready-made preparations. Full particulars about spraying may be obtained from district officers of the Fields Division —it is important to bear in mind that incorrect procedure in any particular may lead either to damage to the crop or to failure to control the blight.

Summer Tillage and Moisture of Soil.

In a figurative way, which is nevertheless well justified by the facts, gardeners sometimes refer to cultivation of the surface soil during dry weather as "hosing with the hoe." Underlying this expression is the fact that the maintenance of a loose layer of soil at the surface is of particular value under dry conditions as a means of preventing loss of soil-moisture by evaporation from the surface. Since antiquity this fact has been applied in successful systems of dry land agriculture in which moisture is saved by a most thorough system of tillage which maintains the loose condition of the surface layer, known as a soil mulch. The full practical significance of the influence of suitable tillage on supplies of soil-moisture can be gauged only when it is remembered that in many districts, and especially in the drier ones, a most common cause of unnecessarily low yields in crops is inadequate moisture in the soil. Further, cultivation begets soil-aeration, which leads to some changes that increase fertility. Because of all this, summer tillage usually proves particularly profitable in the growing of such crops as mangels, potatoes, carrots, and swedes in rows wide enough apart to allow of intertillage.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Control of Pests and Diseases.

THE continuation of spraying, as previously advised, will be necessary until at least the end of January, and in many instances a further one or two applications may be necessary for the control of the various fungous diseases and insect pests in pome fruits.

Good control of red-mite is extremely important if the fruit is to be kept free from mite eggs and the tree healthy. If the foliage is allowed to become bronze in colour, due to mite infection—as unfortunately occurs only too frequently—it is logical to conclude that the foliage cannot function as it should, and that as a result many of the blossom-buds being formed will prove to be too weak to set fruit in the following season. The control of red mite is readily effected by two applications of summer oil at a dilution of 1 to 2 per cent. The time of application depends largely on the severity of the infection and the need for sulphur sprays. In most instances it is best to make the first application early in February and the second ten days later. About fourteen days should be allowed to elapse before applying an oil spray following a sulphur spray. If the foliage is in poor condition, this period should be extended.

There is evidence which indicates that the addition of nicotine sulphate, at a dilution of 1–1,000, to summer oil sprays effects a considerable improvement in the control of mealy-bug. Consequently where this pest is in evidence, or has been troublesome during the previous season, this spray is recommended.

Botrytis-rot (eye-rot) injury in or near the calyx at times causes considerable loss, particularly in certain varieties. Investigations into the cause of this trouble indicate that the initial injury is due to soluble arsenic, and that the rot is a secondary result. The presence of soluble arsenic in spraying combinations can be avoided if the mixing of the various specifics is done in the correct manner. See notes below regarding the mixing of sprays.

Stone fruits should still receive attention by periodical applications of lime-sulphur 0·083 per cent., plus colloidal sulphur 2 lb., per 100 gallons for control of brown-rot, shot-hole, leaf-rust, &c. An application just prior to the earliest fruits reaching maturity is of the utmost importance in the control of brown-rot. Summer oil 1 per cent., or nicotine sulphate 4 per cent. (1–800), can be applied where necessary for the control of green or black aphis. Leech (pear-slug) can be readily kept in control on plum or pear trees by spraying with lead arsenate 1½ lb. plus hydrated lime 3 lb., per 100 gallons water, whenever the pest becomes troublesome. Leaf-roller caterpillar on apricots, peaches, or nectarines can be kept in control by spraying with 1 per cent. summer oil—these trees will not tolerate arsenate.

Mixing Sprays.

By mixing certain spray combinations in the wrong way not only may the fruit and tree be injured, but the effectiveness of the spray may be reduced in no small measure. Inefficiency in this way is most common when lead arsenate is combined with lime-sulphur. A faulty mixing of these two specifics is usually indicated by the mixture turning a muddy black or muddy green colour, instead of remaining the same colour as when lime sulphur is used alone. This discoloration indicates that a chemical reaction has taken place, leading to the liberation of a soluble arsenic compound, which is liable to cause spray injury and impair the efficiency of the mixture as fungicide.

The method of mixing recommended is to add the required quantity of lime-sulphur to the spray-tank as it is being filled with water. Mix the lead arsenate with a small quantity of water in a separate vessel, using

sufficient water to make a thin liquid. Hydrated lime must also be added to the mixture, and this should be creamed before adding to the lead arsenate. When the spray-tank is almost full, add the arsenate-lime solution slowly to the lime-sulphur solution with the agitator working. Regarding the quantity of lime to use, this will depend on the quality of the lime. For a good-quality hydrated lime—*i.e.*, one with a high calcium hydroxide content and a small percentage of large particles—use two to three times as much lime as lead arsenate.

Cover Crops.

The growing of cover crops in established orchards has been proved of considerable value in maintaining the general vigour of the trees, particularly on land that is naturally deficient in humus. Leguminous crops are recommended for this purpose on account of their value in adding nitrogen to the soil. Blue lupin is extensively sown for this purpose and is suitable for most districts. Other legumes suitable for cover crops in orchards are tares, partridge peas, and white lupin. (In a small trial with tares carried out on clay loam soil in the Motueka district during the past season the variety *V. Narboresis*, Moscow, proved superior as a cover crop to nine other varieties of tares used in the same trial.)

The time for sowing cover crops must vary according to the local conditions. In the colder districts where a long winter with severe frost is likely to check growth it is desirable to sow early in January. In the warmer districts where growth will continue during the winter months sowing in the latter part of February or early March is recommended. The use of 2 bushels of lupin-seed per acre is advised for cover crops.

Handling Stone-fruit Crop.

All stone fruit is extremely perishable, and so requires most careful handling. Picking bags are generally unsuitable for use in harvesting this class of fruit, owing to the risk of the fruit being bruised, and, as a result, developing brown-rot before it reaches the consumer. A very few decaying fruits in a case of otherwise sound fruit might readily reduce the market value of the whole case out of all proportion to the number of fruits affected. Consequently every possible precaution should be taken to ensure the fruit reaching its destination in a sound condition.

Budding.

Budding is a quick and effective method of changing a tree to another variety. While used principally on stone-fruit trees, it is also equally successful on pome-fruit trees. On trees where grafts of the present season have failed, shoots arising from the stock can be budded, and so take the place of the dead graft. Buds for this purpose should be taken from the current season's growth and inserted into growth of the same age.

The time to bud is influenced by the state of preparedness of the stock. The tree or the shoot of the tree to be budded should still be making growth when the operation is performed, otherwise there will be no flow of sap to form the union. If budding is done too early in the season the sap will flow through the wound excessively and often result in the death of the bud. As a general guide, cherries can be budded in December, apricots in January, plums, apples, and pears in February, and peaches and nectarines in late February or March.

Buds should be selected from a shoot that is still making growth. It is advisable to take the buds from near the centre of a shoot, which buds are usually more suitable than those near the base or near the extremity of the shoot.

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

As indicated in last month's notes, cultivation should be attended to in order to conserve the moisture during periods of dry weather—land which is inclined to be lumpy can be reduced easily to a fine condition after a light shower. At this period of the year heavy demands are made upon the trees after producing a heavy crop of blossoms. If cultivation cannot be done, the trees should be mulched with some well decayed animal manure or old stack bottoms, taking care not to place any animal manure close up to the trunk, as it may become injurious.

As much of the fertilizers applied earlier in the season will now have been used up, the trees would benefit by receiving an additional dressing of some nitrogenous manure such as sulphate of ammonia or nitrate of soda at the rate of about 2 lb. per tree for a full-sized tree and less quantities for smaller trees. The application should be made during periods of showery weather, and if worked into the soil the fertilizer would become immediately available.

Much useful work can be done if some of the young lateral growths are pinched back when they have made about 12 in. of new wood. This pinching will induce more side growths to develop, which later will develop into fruiting laterals. At times one is confronted with long bare laterals with only a few fruits on the end, and this can be avoided if the ends are pinched out as indicated. If there be produced in the centre of the tree strong sappy young growths which might develop into strong useless branches they should be taken right out in the early stages, thereby obviating the cutting-out of large limbs later on.

A sharp lookout should be kept for thrips, and where they are troublesome the trees should be sprayed with either nicotine sulphate 1–800 plus 3 lb. of soap per 100 gallons or one of the summer oils at a 2-per-cent. dilution. As thrips attack mainly the under-side of the leaves, very careful spraying is necessary in order to reach them. However, where careful spraying is carried out no trouble should be experienced in keeping them under control.

A scale (*Ceroplastes rusci*), which was first recorded two years ago, appears to be spreading, and growers would be well advised to keep a sharp lookout for it. This scale somewhat resembles a small star in appearance, and as it may become troublesome if not kept in check growers should spray for its control as for other scale insects until such time as some definite means of control has been found. The usual summer oil may be used at the following strength: 2 oil, 98 water. The application should be thorough, and two or three subsequent sprays may be necessary at about twelve-day intervals in order to become effective.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Current Topics.

WITH the hatching operations completed for another year and little culling having yet been carried out, together with the rapid development of the young stock, the accommodation available on the majority of plants will be taxed to the utmost, with the consequent risk of the quarters becoming overcrowded with its attendant evil effects, and the necessity for culling out every bird that is not likely to show a profit over its keep is therefore apparent. This implies the weeding-out of all surplus cockerels that have attained a marketable age—*i.e.*, about five months old. In addition, it will pay to dispose of all old stud males at once. It is seldom that the male bird can be depended upon for breeding purposes after the third

season, and the keeping of such stock means a continual drain on profits. Even young males which are showing signs of an impaired constitution, and which do not promise to be serviceable for future breeding purposes, should also be got rid of. It should be remembered that strong constitutional vigour is the basis of resistance to disease and heavy producing stock, and that no bird which is lacking in this respect should be retained on the plant for breeding purposes. There is considerable advantage in having all unprofitable stock out of the way. Not only are the evils resulting from overcrowding minimized, but there is a saving in the present costly foods, while, in addition, the clearing-out of unnecessary birds allows more space for the young pullets, to say nothing of the saving in labour and attention.

Heavy Mortality among Artificially Reared Chickens.

It is safe to say that thousands of chickens being artificially reared have been lost this season, due to a trouble induced by overcrowding and insufficient ventilation. The effect of the sweated condition is manifested in several ways, the chief of which is an inflammation of the veins, the visible signs of which are swellings in the joints, with a gangrenous condition supervening. The swellings and discoloration first make their appearance in the hock joint, and then travel to the wing. In a few days the neck and head swell and then death is not far off. In such cases, which arise solely from improper management, nothing can be done for the chickens badly affected. Those in the early stages may be saved and the trouble prevented from spreading to the healthy chicks by providing the proper night conditions. There is no cure for this trouble, but it is not infectious, and it is merely a question of prevention. Above all, one should not overcrowd, but should provide ample ventilation, keep the quarters clean and dry, and avoid everything that tends to create a moist atmosphere As a further means of preventing trouble from sweating, the chickens should be encouraged to perch at an early age, for once they have acquired this habit the trouble is seldom, if ever, experienced, provided that special care is taken to see that the young birds are not overcrowded. This trouble not only affects chickens during the brooder stage, but also after they have been transferred to the colony house. In many cases of complaints received recently regarding mortality in chickens from this trouble, the owners generally regard it as some new mysterious form of disease over which they have no control. The writer has been familiar with it for well over a quarter of a century, and invariably the cause could be traced to subjecting the chickens to improper night conditions and most particularly to the practice of overcrowding. The overcrowding means huddling, and consequently this leads to the birds getting in a sweated condition, which is undoubtedly the sole cause of the trouble. It is true that the most experienced men in the business of poultry-keeping have much to learn in regard to artificial rearing, and it is only to be expected that the layman, or even the person with some experience but who does not possess a special aptitude in the work of brooder management, will fail to rear chickens always with success. In the case of some of the plants investigated the mortality was put down to various causes, such as a weak constitution possessed by the young birds purchased as day-old chicks, the commercial chick food being fed, and also to the style of brooder being worked, but it is clear that improper management was solely responsible. In the work of artificial chicken-rearing, the point should never be lost sight of that the best brooder ever manufactured, or the best set of instructions ever framed, will fail to spell success if the person in charge of the rearing operations is incapable of thinking out things for himself and applying the knowledge of the necessary work which is now available. There are so many things responsible for successful rearing by artificial means that it is necessary to look for the cause in many quarters. For example, in the Department's Bulletin No. 66, "Utility Poultry-keeping," an illustration is given of a frame and particulars thereof which was devised

at the Wallaceville Poultry Station to eliminate sweating with brooder chicks, and which consequently has had a highly desirable effect in preventing the trouble referred to, and which is commonly known to experienced poultrymen as "green-leg" or "green-wing," for the reason that when the trouble is present these parts generally become affected as well as the head and throat; but even where such a frame is used the trouble may make its appearance at any time if the essential precaution is not taken to prevent overcrowding. This implies that the smaller the number of chickens placed together during the brooder stage, or after they have been transferred to the colony house, the less risk there will be of their becoming affected with this dread trouble. It is safe to say that overcrowding is one of the most common mistakes made in the rearing of brooder chicks to-day. One should never be tempted to put in just a few more, but work only with numbers that can be handled with absolute confidence.

It frequently happens that from four to five hundred chickens are placed under a canopy brooder or in a colony house having a capacity for only half this number. The writer has been tempted on several occasions of late to advise owners whom he has visited to put a sign over every doorway and gateway on the plant, "Don't overcrowd," as it is well known by successful poultrymen that, whether it be with growing or adult stock, the smaller the number of birds placed together, in reason of course, the greater will be the success achieved. Overcrowding in itself is bad enough, but when combined with dirty quarters it is not to be wondered at that heavy mortality takes place under such conditions. It is surprising how some breeders will go on year after year losing their chickens in large numbers, and contenting themselves with the idea that some mysterious disease over which they have no control is responsible. The blame is usually attributed to bad luck, but there is no bad luck about it. In practically all the brooder troubles investigated the disease is not found in an epidemic form. All the troubles have been the result of mismanagement in the rearing of the chickens, faulty incubation, or to weak or improperly managed parent stock. It may be mentioned that previous to the advent of the popular canopy style of brooders, green-leg in chickens was seldom met with during the brooder stage, probably because, with the old style of heated brooders used, one hundred chicks was generally regarded as the maximum number that could be placed together in a brooder if the young birds were to be successfully reared. Now, however, it is not uncommon to see several hundred chicks being placed under a canopy type of brooder, so that, unless the young birds are subjected to nothing but sound management, particularly during a hot muggy season as has been experienced of late, green-leg and other troubles caused by the young birds becoming in a sweated condition is openly invited. Over a long period of years, however, the trouble was frequently met with in chickens after being removed from the heated brooders to a colony house, and particularly where they were subjected to overcrowding, damp, ill-ventilated quarters, and were not encouraged to perch at an early age.

Thin-shelled Eggs.

The production of thin-shelled eggs is a common occurrence at this period of the year, when the great majority of the birds are giving a maximum egg-yield. The trouble is usually due to insufficient shell-forming material being supplied, or to the birds being overprovided with rich foods, such as milk, meat, meat-meal, &c. As a preventive, an amply supply of broken oyster or other sea-shell should be available to the birds at all times. If this does not bring about the desired improvement, the only safe course is to feed less of the forcing ration.

As to the method of supplying broken shell, or indeed grit of any kind, some people make the mistake of providing these materials in a narrow receptacle into which the birds can merely put their heads. A much better plan is to place the material in a wide box, or even on the ground, so that

the birds are given an opportunity of scratching it about and picking out the pieces they like best. Especially is this necessary when both gravel-grit and sea-shell are mixed together. It must be remembered that the laying bird will consume more than double the amount of shell in proportion to stone grit. Thus it will be seen readily that owing to the latter being in the way and the birds being unable to scratch over the material themselves, they may easily be prevented from securing the necessary egg-shell-forming material so much required by them, especially during the heavy producing season.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Control over Breeding.

One of the most important factors in the successful practice of modern apiculture is securing control over the breeding, and this can be obtained by compelling the bees to build whatever comb is desired.

Under natural conditions, or when in hives and allowed freedom to construct combs, bees invariably build a large proportion of drone-comb, which is subsequently utilized for breeding drones. Some drones are needed for the impregnation of young queens, and usually a sufficient number for the purpose will be bred even when the breeding of them is restricted by making the fullest use of worker comb-foundation. The comb-foundation obtained from manufacturers is impressed with the bases of worker-cells, and by the use of full sheets good worker-combs are usually obtained. However, accidents may happen to the combs; portions of the foundation may break away under the weight of a good swarm, and other portions sag and stretch, owing to the comb-foundation being carelessly fixed. In such circumstances the bees will quickly build drone-comb, and thus defeat the purposes for which the foundation was originally designed.

The replacement of such combs is a matter of urgency, otherwise countless drones will be raised and the toll on the stores gathered by the workers will result in the ultimate returns from the hive being considerably curtailed. The beginner will be loath to remove the combs containing drone-cells, on account of the presence of worker-brood. To reduce the number of drones being reared he will be tempted to bring into use drone-traps, which hamper the access of the worker-bees to the hives, or he may elect to destroy the cappings on the cells. Such measures are ill advised, and cannot be counted upon to remedy successfully the drone trouble. The most effective way to prevent the rearing of drones is to remove the combs containing the drone-cells. This may be accomplished by removing the combs from the centre of the brood-nest to the side of the hive, or by placing them in a super over an excluder. When the worker-brood has hatched the combs should be removed altogether.

After-swarms.

The beekeeper should give some little attention to the prevention of after-swarms. These swarms are a nuisance, and weaken the parent hive without being of much value in themselves. If the colonies are left undisturbed they will swarm freely, and all chance of a surplus is lost.

Among the many plans practised for their control the most successful is that which provides for removing the parent hive. This method is an excellent one, and will usually prevent the issue of the small swarms. As soon as the swarm is hived the parent hive should be removed to a new location n the apiary, and the swarm put on the old stand. The effect of this change is to strengthen the swarm with the field bees which are absent gathering nectar, and correspondingly to weaken temporarily the

old hive, so that it will rarely put out a second swarm. The emerging bees in the parent colony will soon provide sufficient workers to ensure a surplus, and the tendency to swarm will not be so prevalent. In order to make the operation more successful the parent colony should be examined for queen-cells, and they should be all removed except two.

After-swarms should always be returned to the parent colony unless they are required for increase In the latter case it is a good plan to dump two or three swarms together, and thus form a strong colony that will gather sufficient stores to carry on through the winter In dumping it is advisable to shake the swarms on to an excluder placed between the supers, so as to take out the young queens. Before returning an after-swarm, overhaul the parent hive and cut out all the queen-cells. Place two or three empty combs or frames fitted with sheets of foundation in the brood-chamber, and put the brood over an excluder to hatch out. In case the colony contains a virgin queen the combs, before being placed over the excluder, should be shaken in front of the hive to make sure that the virgin queen is not confined above the excluder, or she will not get mated, and a drone-raising colony will be the result. A good plan at all times is to provide an opening for the bees between the super and the brood-chamber, which can be done by inserting a small block of wood immediately under the edge of the super. This will allow the bees to fly freely, and in case the virgin queen is by accident confined to the super, an opportunity will be given her to fly and get mated. Likewise the drones can pass out of the super. If on making a later examination the queen is discovered in the super, she can be placed in the brood-chamber, under the excluder.

Foul-brood.

As advised last month, beekeepers should not fail to treat diseased colonies where found This work should be carried out in advance of the main flow, so that undivided attention may be given to securing a crop. Over and over again the treatment of disease is delayed until such time as the season is advanced, and as a result the affected colonies do not count as producers in the main crop; whereas if treatment is carried out as soon as nectar is being secreted freely, these colonies will be in good heart to produce a surplus. When in doubt as to the presence of disease, it is advisable to forward a sample of the comb addressed to the Director of the Horticulture Division, Wellington, or to the district Apiary Instructor, for examination.

Queen-excluders.

The season is at hand when it is advantageous to use queen-excluders During the height of brood-rearing, in order not to cramp the queen, she should be allowed the full use of the super, so that large numbers of worker-bees may be raised to work the main crop. It is not wise to bring the excluders into use too early, and it should never be done until the bees are working freely in the super. By cramping the queen fewer bees are produced, and small returns will be netted. Every encouragement must be given the queen to lay to her utmost, and by doing so populous colonies will be produced.

The best time to put the excluders on the hives is when the main flow sets in and the bees are busy bringing in nectar. Too many beekeepers make the mistake of putting on the excluders when the supers are first placed on the hives, and it is not an easy matter to get the bees to work in the supers even if combs of honey are raised from the brood-chamber, as excluders tend to make the passage between the lower story and the upper more difficult. Before placing the excluders, it is advisable to make a careful examination of the colony to note its condition, and to take stock of the number of frames of brood in the hive. If the brood-chamber is full of brood the combs may be manipulated so as to provide the queen with ample room for laying during the period which follows. The best

plan is to place the majority of frames of capped brood over the excluder, and to substitute empty combs, taking care to see that the queen is confined below. As the bees hatch out over the excluder, they will become accustomed to passing through it, and as fast as the cells become vacant they will be filled with honey. If eggs are raised with the brood care must be taken to see that the bees do not raise queen-cells, for in the latter case the hive may swarm out, leaving one or more virgins in the top story, and these queens, being confined to the hive, cannot get out to be mated, and will eventually develop into drone-layers. Within one week after raising the brood examine the combs in the super to note if any queen-cells have been raised. If any are found they must be destroyed.

The advantage of the use of queen-excluders is in saving labour at the time of extracting, by doing away with the work of picking over the combs. Much time is lost in this operation, and extracting is retarded when everything should be hurried. It is only by the use of excluders that bee-escapes can be employed, and in many seasons, depending largely on the weather, these have to be brought into use.

Treatment of Swarms : Provision of Supers.

There is a little doubt in the minds of many beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame hives and not provided with room for surplus. Unless supers are given to strong early swarms from ten to fifteen days after they are established, these colonies will often swarm again, and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, but large amounts are lost yearly through the beekeeper neglecting to give ample room for the swarm to store honey.

When a swarm has been established a few days, a quick examination should be made to note progress, and from this the beekeeper will be able to form some idea as to the time at which the super will be required. Nothing works so well as a swarm under proper treatment, and the attention given in providing supers will amply repay the beekeeper.

Queen-rearing.

In last month's notes attention was directed to queen-rearing. Every effort should be made to requeen the apiary during the working season, so that the colonies will go into winter quarters headed by a good queen. It often happens that the beekeeper is dissatisfied with his stock, in which case his best plan is to send direct to some reliable breeder and secure a number of good queens. Whether this suggestion is carried out or not, when raising queens the beekeeper should select the best stocks in his apiary ; in other words, queens should be raised from queens whose bees have a record as honey-producers.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

EARLY potato crops are now being lifted, and there is usually little danger of loss through the attack of the fungous disease known as late or Irish blight. In the case of main crops which do not ripen until late autumn there is considerable danger of loss from this cause in some districts, chiefly those which experience warm humid weather at this season of the year, or where infected seed has been planted. Where this danger exists the potato crop should be sprayed with bordeaux 3–5–50, when the tops are dry, with a view to preventing the spread of the disease, the application being

repeated, as necessary, at intervals of two or three weeks, so that new foliage may be covered, and the dressing renewed where it has been washed off by heavy rain. The successful use of this spray depends on proper mixing and a thorough application being made in the form of a fine mist. The 3 lb. of bluestone may be dissolved in hot water and added to 40 gallons of water. The 5 lb. hydrated lime is then mixed to a fine paste and diluted to the extent of about 5 gallons, and then *slowly* poured into the bluestone solution, thoroughly stirring it meanwhile. The mixture should be used at once, as considerable deterioration takes place if it is held over; so long as the solutions are kept separate, however, they will keep for a long period. For spraying potatoes, washing-soda may be used in the place of the hydrated lime; the spray material is then spoken of as Burgundy mixture. Another important precaution is to make the bluestone solution in a wooden vessel; if metal is used both the vessel and the solution are likely to suffer.

Onions and shallots planted out in early spring will soon commence to ripen; they are best lifted before the autumn rains commence, and in humid districts should be dried off under cover where good ventilation is available.

Where any of the following winter crops are to be grown they should be planted out not later than the month of January: savoy and red cabbage, kale, broccoli, cauliflower, leeks, and celery. It is to be remembered celery is a water plant, and should never be allowed to become dry. The protection of these crops from pests and disease has been dealt with in recent notes they will require close attention for a few weeks.

Late crops that may be sown now are dwarf beans; peas, of an early variety, shorthorn carrots; globe beet, turnips; radish; spinach; silver beet; lettuce; and parsley By sowing thinly, much of the labour of thinning the young plants will be avoided, the seeds also will probably "go" twice as far. Most samples of seeds of the above kinds of vegetables have a high percentage of germination.

Tomato Crops.

Towards the end of the month of January the harvest under glass will be drawing to a close and that of the outside crop just commencing. The valuable qualities of the tomato are becoming better known; a full-flavoured juice, without preservatives, is now on the market; it is an exceptionally refreshing drink, especially for people who have been working or playing hard. Also a paste is made which is appetizing and satisfying; it is an ideal filling for sandwiches. As a *purée*, sauce, or chutney, during the winter especially, this fruit is an old favourite. With so many popular uses very little of the fruit grown should be wasted; unfortunately, waste sometimes occurs. The modern system of shipping the goods on consignment to distant markets by a number of small individual consignors has the effect of making it difficult to maintain the steady supply on the market which is necessary for maximum consumption. This is a problem which requires the careful consideration of shippers at the present time.

In warm districts, especially where the crop is growing in a loam overlying a shingly subsoil, and the rainfall is irregular, an adequate supply of water in the soil can often be secured at this season of the year only by supplementing the natural supply. Artificial watering is done best where there is an ample supply of humus in the soil; such soils as that mentioned should receive every consideration in this regard.

Small Fruits.

Fruiting plants which carry the crop on the one-year-old wood only are very commonly pruned soon after the crop is harvested, the method usually being to cut out the wood that has borne down to a bud at its base. This has the effect of getting rid of most of the disease which

may be present on the plant, allowing the sun to ripen the young wood for next season's cropping, and facilitating the application of any sprays that may be necessary. Small fruits requiring this treatment are raspberries, loganberries, and black currants. The prunings should be carried out and burnt.

Whether the pruning is required or not, plantations of small fruits should be cleaned up as soon as the harvest is over and given treatment that will put them into good condition for another crop. Where well-rotted farm manure is scarce it is often an advantage to apply to the land a dressing of phosphates and sow it down in a cover crop for turning under later. Strawberry-beds which have reached the end of their usefulness should be worked up and planted with a winter crop, such as broccoli. Before doing this it is advisable to look over the old plants and make a selection of the most healthy of those which have a good cropping record : planted out in a piece of fresh ground they will make good stock plants from which to obtain runners for further planting. Where new plantations of small fruits are to be made, the ground will probably be available as soon as an early crop of vegetables is harvested . the ground should then be taken in hand, cleaned, and well stocked with humus in preparation for planting strawberries during the autumn or bush fruits during the winter. As these crops are comparatively permanent, the preparation should be good, especially as regards the eradication of bad perennial weeds.

The Homestead Garden.

The fine display of hydrangeas and roses at recent shows amply demonstrates the suitability of these plants for first-class results on many classes of soils. The plants mentioned also provide their generous harvest of blossom during summer and autumn, when most of our flowering shrubs are long past that stage. They are therefore of particular value in maintaining a good display in the latter portion of the procession in the floral carnival of the garden. We are under a great debt of gratitude to the hybridizers who are producing hydrangeas in such a variety of form and colour that was quite unknown but a short time ago. The output of the rose specialists has much improved ; new varieties which have only sensational colours, possibly only in the bud stage, have been quite surpassed. The best new varieties now have—in addition to good colour—constitution, form, and, in many cases, fragrance. No better material could be desired for a display in the home garden at this season of the year. To make the best of it the selection of varieties and arrangement in the garden require considerable study. The old mistake of setting the plants singly at more or less regular intervals along a shrubbery or herbaceous border should be avoided. Roses may have a place in the shrubbery border if the most vigorous species and varieties are chosen ; they are often admirably suited for such a position. Medium and dwarf varieties, however, never look better probably than in special beds in a rather open position with a shrubbery border for a background and for shelter purposes.

In dry localities hard-wooded plants set out during the spring may now require watering and possibly a mulch on the surface of the ground over the roots, to retain the moisture. Those set against a wall are specially likely to need this attention until the roots have spread to moister ground.

Aphides are a universal pest on young growth in dry weather. Systematic weekly attention will protect choice plants effectively. A puff or two of a strong soap solution will destroy the colony, or the addition of a little nicotine may be made to dispose of the more difficult kinds.

Rambler roses growing in positions where neat training is desirable may now have the old flowering shoots removed and the young growths tied in to take their place ; if there are more of these than is necessary they should be thinned out.

During the month of January cuttings and layers of soft-wood plants may be taken.

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

JAUNDICE IN EWE.

J. G. H., Te Kawa West :—

I opened up a ewe that died, and found that the gall-bag was about five times its normal size, full of gall, and that the rest of its organs were quite healthy looking. Could you tell me if it would be the gall that was the cause of its death ? The fat was discoloured and yellowish.

The Live-stock Division :—

It is quite likely that this ewe died from jaundice, and that there was a blockage of the gall-duct that leads into the intestine.

UTILIZATION OF MANURE FROM DAIRY SHED.

T. B. C., Onehunga :—

I desire information about means whereby the dung and urine, which is a most valuable manure, from a dairy shed could be conserved.

The Fields Division :—

Under New Zealand conditions, the only method in practice is to catch the wash from the shed in a tank, whence it is pumped into a barrel or tank on wheels and distributed daily over the fields The best practice with the dung is to distribute daily on to the fields, avoiding the collection of heaps at the shed.

RIPENING OF EARLY SUMMER PEARS.

P. D. L. H., Gisborne :—

A dessert-pear tree, twenty years old, sets a heavy crop of fruit which always looks quite healthy until about the end of December. At that time the fruit is large and quite green ; the pears then commence to drop off, the stem comes away from the twig, not from the fruit, which to the naked eye does not look different from a picked fruit.

The Horticulture Division :—

It is quite natural for early summer pears to wither or decay if they are kept for even a comparatively short time. The variety is probably Citron des Carmes, an early dessert pear which should be eaten before the green colour changes.

TRANSPLANTING OF VINES.

G. H. M., Wanganui River :—

Is it possible to transplant grape-vines successfully ? Can the grape be propagated by layering the vines ?

The Horticulture Division :—

Old vines can be transplanted successfully after cutting back the rods to an inch or two of the main stem and treating the roots in the same manner. You can obtain new vines by layering a rod of last season's growth, covering it with 3 in. or 4 in. of good soil. Each bud will grow a shoot and roots in the spring, and the following winter the rods can be divided into separate plants, and these removed to the permanent position or left *in situ* for another season.

TREATMENT OF BAD QUARTER.

W. C. A. B., Tangiteroria :—

Should a bad quarter in a cow be syringed out, and, if so, what solution should be used ?

The Live-stock Division :—

It is better to milk out a bad quarter four times daily than to syringe out with anything. Injections have been used with varying results, many different drugs used, and no better results obtained.

EGG-BOUND CONDITION OF HENS.

G. H. M., Seddon :—

Is there any cause of an egg-bound condition of hens known to your Department, or anything which makes for predisposition of this trouble ?

The Live-stock Division :—

Sometimes this condition is brought about through two yolks leaving the ovary and falling into the oviduct at about the same time, causing the formation of a double-yolked egg, which, owing to its abnormally large size, will not pass through the egg-passage, and as a result the bird is unable to expel it. This applies particularly to young hens in which the oviduct has not become sufficiently dilated to enable a particularly large egg to pass through it freely.

Of course, a pullet may have trouble in passing the first egg or two, until the egg-passage is stretched to its normal capacity. Difficulty in this direction is frequently indicated by the fact that a pullet's first egg is more or less streaked with blood. Old hens which are predisposed to lay large eggs may experience similar difficulty in passing an egg as a result of being in an overfat condition, while, further, the oviduct may not be functioning in a proper manner, resulting in the formation of a misshapen egg, or one with a very rough shell which cannot be passed in a normal way.

Egg-binding may also be brought about owing to an egg becoming broken in the egg-passage, which may occur as a result of a bird being roughly handled or being chased by dogs, &c., while it is commonly caused through the bird's inability to secure sufficient broken sea-shell, &c., in order to secure the necessary lime as a shell-forming material.

CONTROL OF BITTER-PIT IN APPLES.

C. J., Rotorua :—

My Ribstone Pippin apples had bitter-pit rather badly last year. Would liming the ground or any special manure prevent a recurrence ?

The Horticulture Division :—

Bitter-pit is a disease of the apple which has not yet been brought under satisfactory control, and is still the object of considerable research. Sudden fluctuations in the water content of the soil during the development of the fruit is considered to be an important factor in causing the trouble. This condition may be avoided in many cases by improving drainage and increasing the humus content of the soil; or, if the ground is heavy and hard, an application of lime, as you suggest, with a view to making it friable and so less liable to dry out seriously would very possibly be helpful.

SEED OF PAMPAS GRASS.

F. E., Bulls :—

When and how can the seed of pampas grass be saved ?

The Systematic Botanist :—

Pampas grass is a shy seeder, as both male and female plants need to be present for fertilization. The female flower trusses ripen in the autumn, and the seed could be threshed out by hand.

WEATHER RECORDS: NOVEMBER, 1934.

Dominion Meteorological Office.

NOTES FOR NOVEMBER.

NOVEMBER was a very remarkable month. Conditions were unusually uniform throughout the country and everywhere were characteristic of a summer rather than a spring month. The rainfall was the lowest for many years. Temperatures were much above normal, and, although higher mean temperatures have been experienced in previous years, it has never been so uniformly warm. There was no really cold weather. At numbers of places the extreme maximum temperature was the highest ever recorded in November. The lack of rain and the continuous sunshine are causing pastures to become browned in many places, especially on hill slopes. The severity of the heat has, however, been mitigated so far as vegetation is concerned by the lack of wind, especially very strong winds. Though rain is now badly needed, there is still ample feed in most districts. Stock are in good condition and the milk-yield is fairly well maintained. Lambs have fattened well. Shearing has been carried on with little trouble. Crops are, on the whole, doing satisfactorily. Hay is being harvested and ensilage being stored unusually early.

Rainfall.—Good rains were experienced in North Auckland, the November average being considerably exceeded. The same was the case at a few places in the interior of the North Island and the Bay of Plenty district These areas formed only a small fraction of the whole country, and in all other parts there was a very marked shortage Large areas of the west coast of the South Island received less than a quarter of the normal rainfall, and for the whole Island the average deficit was about 50 per cent.

Temperatures.—Temperatures were much above normal, especially at inland stations, the departures in numbers of cases exceeding 5° F. There were very few frosts, and at few places were any sufficiently severe to cause damage.

Sunshine.—The month was a very sunny one, the average being exceeded in practically all districts. Blenheim had 276·8 hours, New Plymouth 275·8, and Wellington 274·9.

Storm Systems.—Storms were conspicuous by their absence over New Zealand. During the first few days a very shallow low-pressure trough moved northwards over the Dominion and caused fairly general though mainly only light to moderate rain.

On the 8th a very deep cyclone developed over Tasmania, but it moved southwards and filled up before reaching New Zealand. The same happened again at the end of the month with a cyclone which caused widespread devastation in Victoria.

The only general rains occurring during the month were associated with a storm which developed into a deep cyclone over the Tasman Sea on the 17th. Rain was very widespread from the 17th to the 20th and the totals were almost everywhere considerable. Even this storm, however, was rapidly losing energy when it crossed New Zealand and the amount of rain produced by it was rather disappointing.

Another slight disturbance passed between the 26th and 28th and caused some scattered showers.

Thunderstorms were rather frequent during the month, and a slight tornado occurred near Christchurch on the 19th. Practically no winds of gale force were experienced. A conspicuous feature of the weather was the way in which disturbances which were vigorous over Australia petered out before reaching New Zealand, and especially the absence of strong westerly winds in such disturbances as reached us. In consequence, even the wettest parts of the west coast sometimes went entirely without rain.

RAINFALL FOR NOVEMBER, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.	Total for Year to Date.	Average for Year to Date.
North Island.						
	Inches		Inches.	Inches.	Inches.	Inches.
Kaitaia	2·76	14	1·47	2·75	56·45	51·68
Russell	3·95	13	1·25	2·22	73·39	47·39
Whangarei	4·62	17	0·97	2·81	58·93	57·52
Auckland	1·17	9	0·26	3·28	41·16	41·96
Hamilton	2·80	9	0·85	4·01	39·06	46·04
Rotorua	4·92	11	1·27	4·15	48·49	51·25
Kawhia	1·82	9	0·95	4·52	43·04	50·42
New Plymouth ..	2·48	8	1·11	4·76	48·99	55·56
Riversdale, Inglewood .	3·61	7	1·29	9·12	75·21	96·69
Whangamomona ..	3·29	6	1·15	7·39	60·51	71·92
Hawera	2·03	6	1·08	3·78	35·57	41·96
Tairua	2·26	15	1·24	3·63	51·87	60·07
Tauranga	2·09	10	0·48	3·25	49·84	48·80
Maraehako Station, Opotiki	4·12	14	1·33	3·16	42·64	50·45
Gisborne	1·67	8	0·45	2·88	24·98	42·83
Taupo	4·90	12	1·90	3·32	39·56	40·75
Napier	1·38	7	0·61	2·36	25·88	32·77
Hastings	1·07	7	0·40	1·82	22·45	29·98
Whakarara Station ..	2·17	7	0·62	..	43·48	..
Taihape	2·30	10	0·89	3·47	28·05	33·69
Masterton	1·85	3	1·08	2·73	31·88	35·67
Patea	2·25	9	1·09	4·01	37·78	41·29
Wanganui .. .	1·21	9	0·60	3·24	30·38	33·42
Foxton	2·18	5	1·30	3·20	31·36	29·87
Wellington	2·16	8	1·19	2·90	43·29	38·24
South Island.						
Westport	2·08	10	0·75	8·85	78·94	88·35
Greymouth	2·00	8	0·62	9·10	84·44	92·90
Hokitika	2·23	7	0·90	10·68	84·66	104·70
Ross	2·09	6	0·84	13·86	102·80	123·44
Arthur's Pass ..	2·23	4	1·08	16·11	144·32	147·80
Okuru, South Westland	4·16	8	1·86	12·60	..	133·50
Collingwood	5·57	11	1·32	6·90	86·94	89·19
Nelson	2·73	11	0·80	2·95	35·55	34·88
Spring Creek, Blenheim	1·00	5	0·36	2·39	30·17	28·18
Seddon	1·27	6	0·40	1·85	28·00	22·84
Hanmer Springs ..	2·16	12	0·81	3·52	48·63	41·42
Highfield, Waiau ..	0·74	4	0·24	2·52	33·74	30·64
Gore Bay	1·88	9	1·18	2·12	37·64	28·70
Christchurch	1·56	7	1·26	1·90	26·37	22·84
Timaru	0·93	7	0·33	1·90	25·18	20·20
Lambrook Station, Fairlie	1·38	7	0·59	1·93	28·64	22·30
Benmore Station, Clearburn	0·90	5	0·59	2·05	23·35	22·30
Oamaru	0·94	10	0·46	1·92	23·27	19·76
Queenstown	0·38	6	0·11	2·78	30·33	27·94
Clyde	1·17	6	0·46	1·34	5·96	13·46
Dunedin	1·43	6	0·65	3·22	38·45	33·25
Wendon	1·41	7	0·52	2·72	25·29	27·14
Balclutha	0·55	5	0·28	2·48	28·61	23·06
Invercargill	1·93	16	0·55	4·39	36·51	41·69
Puysegur Point ..	6·61	16	1·37	8·25	65·85	78·09
Half-moon Bay ..	..	..	..	5·79	..	53·89